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VOLUME 8 ■ NUMBER 3 ■ WINTER 1998

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Global biodiversity

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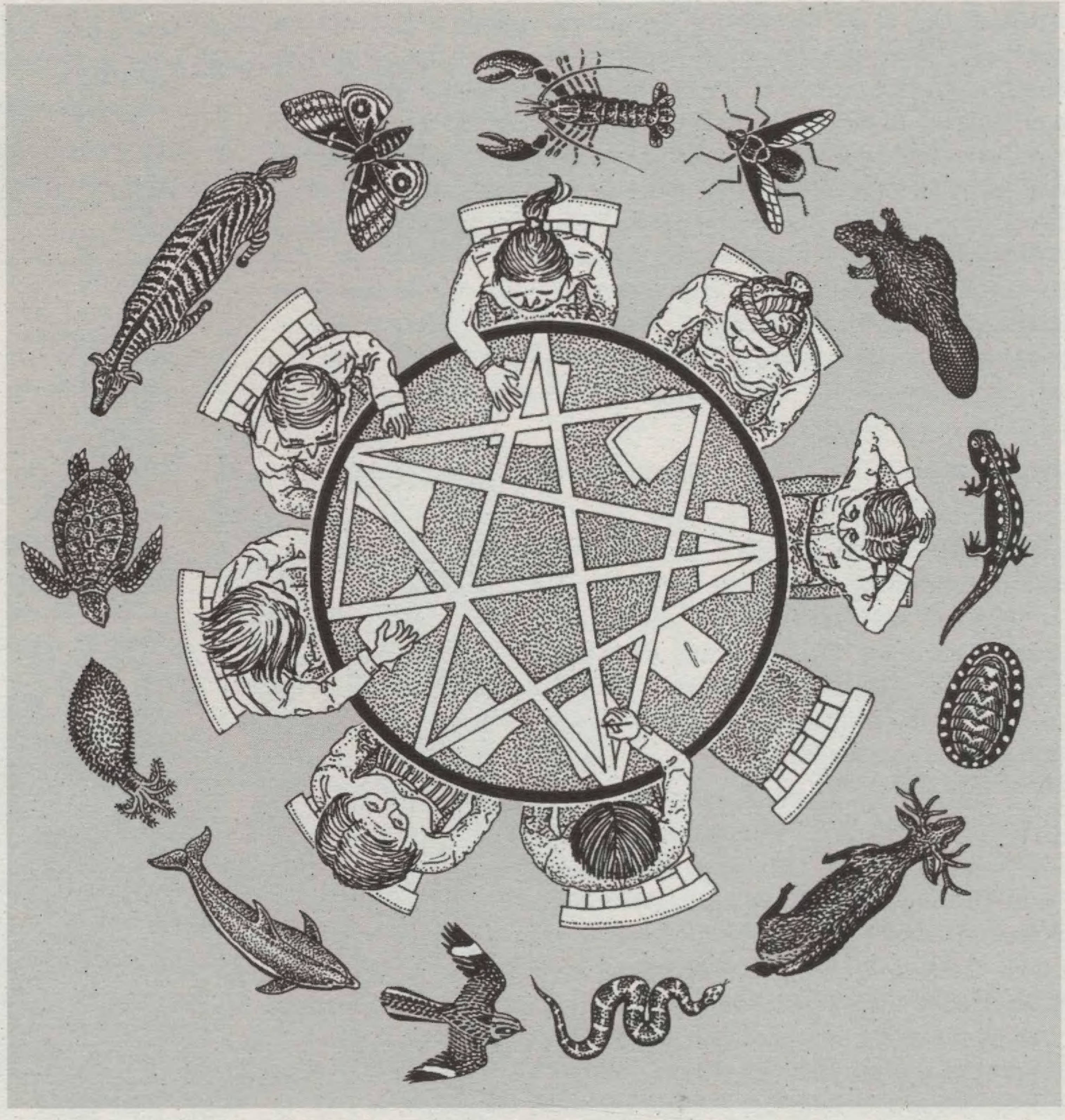

A BIOCULTURAL APPROACH TO DIVERSITY

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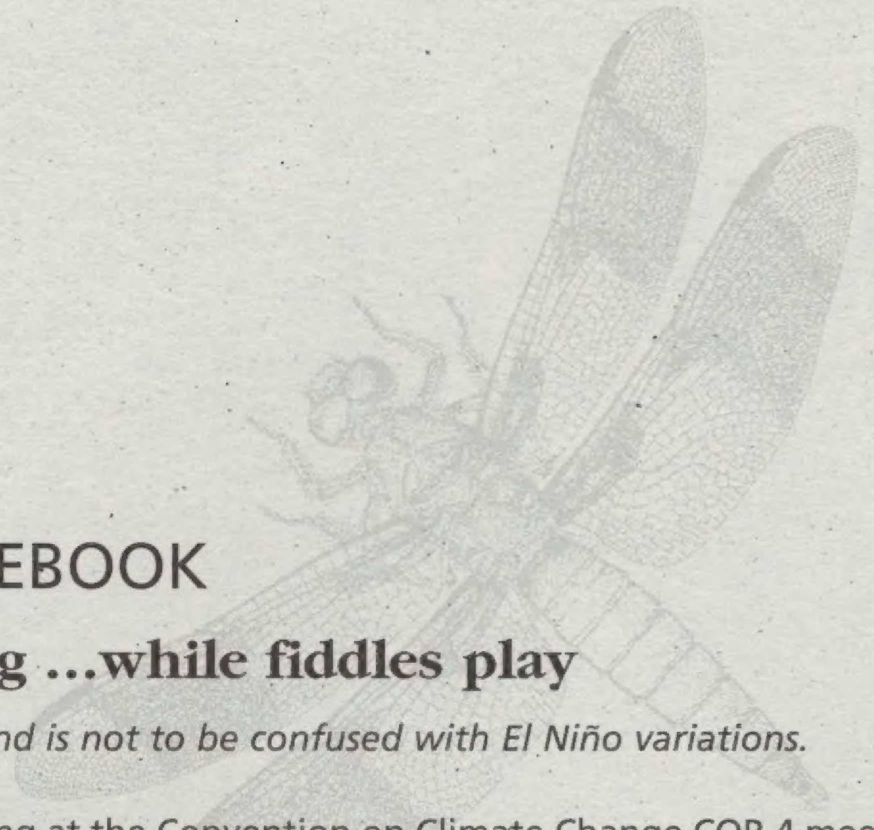

EDITOR'S NOTEBOOK

Climate warming …while fiddles play

Global warming is here and is not to be confused with El Niño variations.

A laboured chorus was sung at the Convention on Climate Change COP-4 meeting in Buenos Aires in mid-November as delegates debated the fate of the Earth. Soft-voiced but earnest delegates of the low-altitude, small-island, developing countries spoke of their risk of disappearing as sea levels rise in response to climate warming. A powerful nation told the developing countries—many hampered by large debt payments—that they should contribute progressively to reduce their level of greenhouse gases as their economies grow. Environmental organizations spoke of the impact of warming on species and ecosystems. Petroleum interests argued their products had minimal influence on warming, while the nuclear, solar and insulation companies maintained that their products would reduce warming. The Hadley Climate Institute demonstrated the difference between El Niño and climate warming, a point over which a few delegations were confused (see graphs on page 30).

While these human voices rose and ebbed, climate warming's impact on nature marched on:

1) New data from the Surface Heat Budget of the Arctic Ocean (SHEBA) expedition confirmed that shrinkage in the area of the Arctic sea ice pack (of roughly 14% between 1978 and 1994) is continuing and probably now exceeds 20%. In addition, the ice is thinning. The Arctic sea ice is the basis for an important ecosystem. A food-chain—starting from diatoms living on the underside of the ice—leads through crustaceans to Arctic cod, seals, sea birds and polar bears. That ecosystem depends on sea ice.

2) Increases in sea surface temperature noted in satellite data from the US National Oceanic and Atmospheric Administration (NOAA) have been analyzed by Drs. Thomas Goreau of Global Coral Reef Alliance and Alan Strong of NOAA. They report that above-normal, warm season temperatures are bleaching and causing mortality of coral reefs over wide areas in the Atlantic, Pacific and especially Indian Oceans. Corals are adapted to their normal temperature regimes and live close to their maximum tolerable temperatures. Temperatures one degree celsius above the warm season normal for one month will bleach corals. Maintaining this temperature for two months (or two degrees above warm season normal for one month) will likely kill many corals.

Coral reefs are richer in species than any other marine ecosystem. Continued warming therefore threatens one of the pillars of marine biodiversity. Ground-truthing (taking remote sensing readings of ground/sea phenomena and verifying their validity with on-site surface results) has shown that the predicted effects are correct: this is now science, not theory. Global warming is here and is not to be confused with El Niño oscillations.

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Global biodiversity (*Gb*) is published quarterly. For more information, go to <http://www.nature.ca/english/gbzine.htm>. Claims for missed issues will be honoured up to six months after the missed issue within Canada, and up to one year outside Canada. *Gb* is a member of the Canadian Magazine Publishers Association and is indexed regularly in the Canadian Periodical Index, Elsevier BIOBASE/Current Awareness in Biological Sciences and Ecological Abstracts. *Gb* is printed in Canada on pH neutral paper made from 100% post-consumer waste without chlorine or de-inking.

Front and Back Cover Illustrations:
Roelof Idema

Version française disponible:
La biodiversité mondiale
ISSN 1195-3101 (English version)
ISSN 1195-311X (version française)

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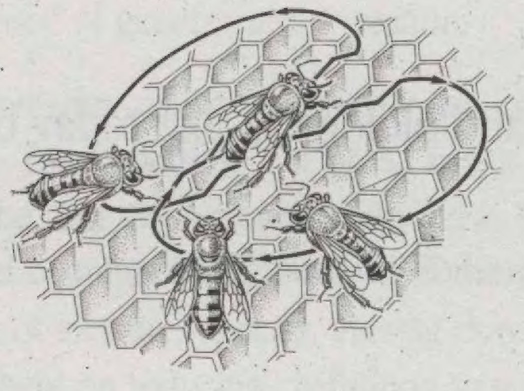

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FEATURE

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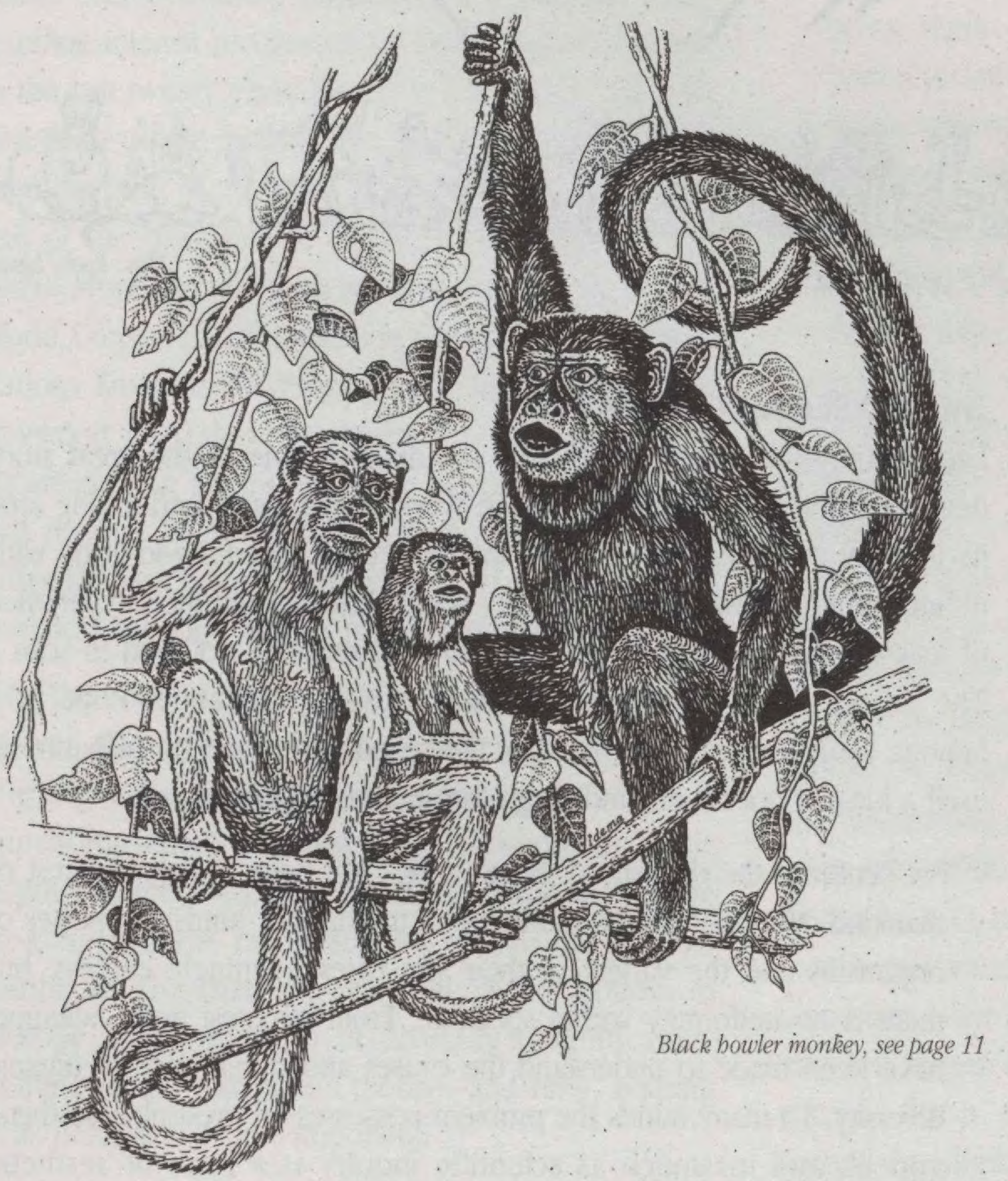
The two great realms of living diversity are cultural and biological, and today both are in peril.

David Harmon, Executive Director, The George Wright Society, and Co-Founder, Terralingua



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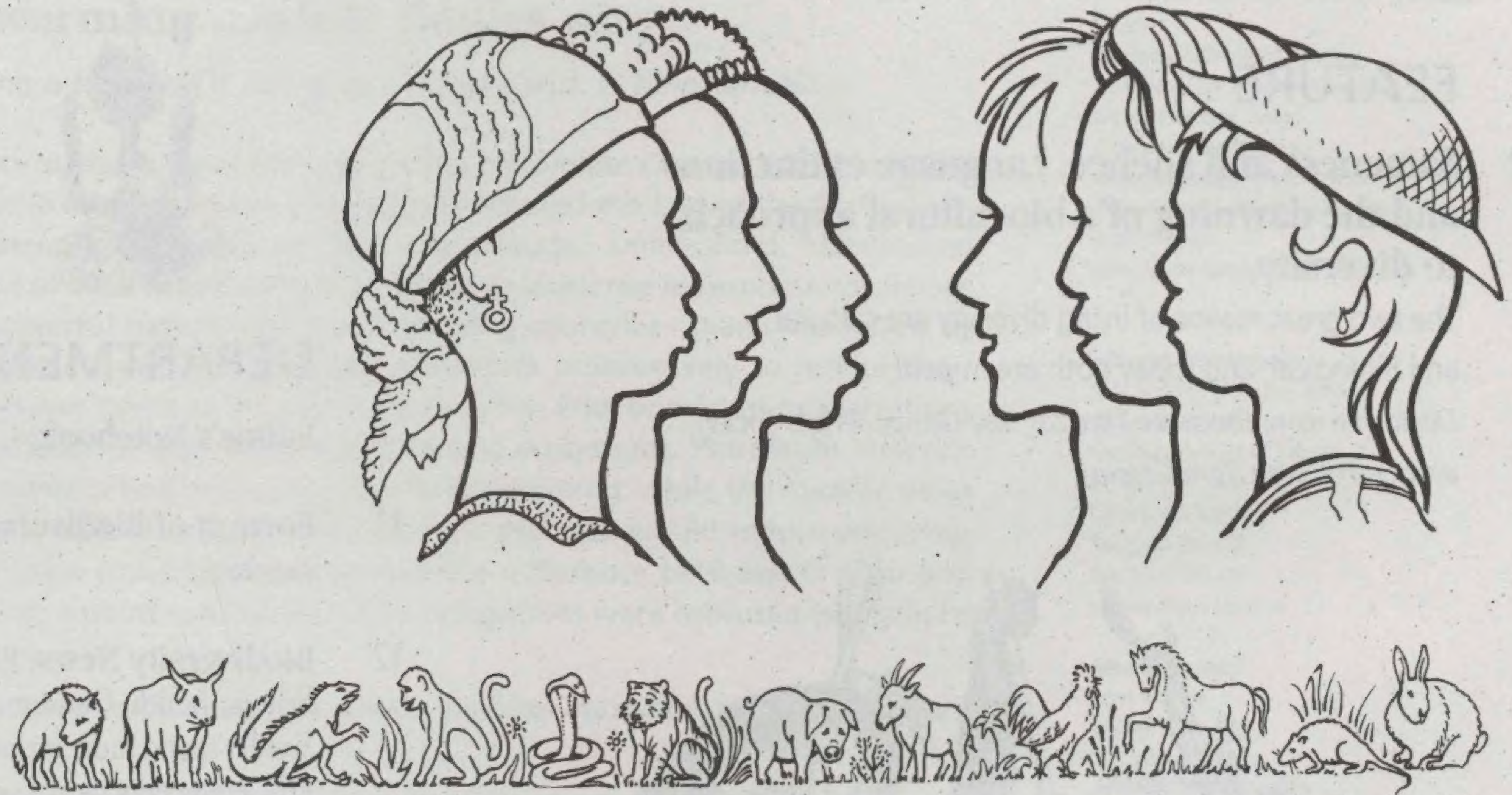
Sameness and silence: Language extinctions and the dawning of a biocultural approach to diversity

The two great realms of living diversity are cultural and biological, and today both are in peril.

by David Harmon, Executive Director, The George Wright Society, and Co-Founder, Terralingua



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THE TWO REALMS OF DIVERSITY

Life's variety—its scope, depth and meaning—is one of the great story lines throughout history. Much of the world's visual and performing arts, its folklore and literature, can be interpreted as a coming-to-grips with difference. For many people, diversity is engaged through their experience of fellow human beings. "Know then thyself, presume not God to scan / The proper study of mankind is man," advised Alexander Pope in a famous couplet. For others, though, the wondrous profusion of nature is itself a kind of poetry, engendering passion and abiding interest:

> "For centuries the diversity of living things has been a major interest of mankind. Not only are the multitude of the distinct 'kinds' or species of organisms and the variety of their structures seemingly endless, but there is no uniformity within species.... From remotest times, attempts have been made to understand the causes and significance of organic diversity. To many minds the problem possesses an irresistible aesthetic appeal, and inasmuch as scientific inquiry is a form of aesthetic endeavor, biology owes its existence in part to this appeal." (*Dobzhansky 1941*)

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Theodosius Dobzhansky used these words to begin his *Genetics and the Origin of Species*, one of this century's major works of biology, a cornerstone of the "modern synthesis" of genetics and evolution.

The two great realms of living diversity are cultural and biological. Today both are in peril, and it is no coincidence. The core of the biodiversity crisis is that we have placed our needs at the centre of the world, eclipsing those of all other species. Having done that, we now seem bent on reducing civilization to a single archetype, that of Western (largely U.S.) industrialized society—a kind of Global America.

The real story is not nearly so simple as this sweeping summary, of course. The grandiloquent "we" is still a rich plurality. Many indigenous peoples, for example, espouse biocentric world views, and exhibit none of the hubris to which the technologically sure-footed West seems all too susceptible. Moreover, the fast rise to prominence of the biodiversity issue within conservation and academic biology is, on one level, a collective statement of dissent against the dominant social and economic paradigm. Despite the long-standing interest recognized by Dobzhansky, it is only in the last twenty years that global biological diversity has come to be analyzed in depth. This period has seen the birth of the term "biodiversity" (Wilson 1988) and of the discipline of conservation biology (Soulé 1985). More recently, two major global studies, by the World Conservation Monitoring Centre and the United Nations Environment Programme (Groombridge 1992; Heywood 1995), have synthesized massive amounts of information on Earth's biological riches, both terrestrial and marine. Scores of scholarly books, several new journals (such as the one you now hold), and countless specialist articles have been produced.

Why the flood of activity, and why now? We know the answer, though some may feel ashamed to admit it. The urgency comes from a feeling of dread of an impending crisis, of a looming threshold of biotic impoverishment—that Rubicon of extinction whose crossing humans might survive physically, but not spiritually. Dobzhansky was right: at the bottom of biology is the question of diversity's significance. Nothing in the discipline's theory—and now, nothing in its practice—is more important.

The same urgency has taken hold in anthropology and linguistics, the two social sciences most interested in cultural diversity. Their concern is globalization, whose foundations go back to the beginnings of European imperial-colonial ambition. Today, globalization runs in overdrive, fired by one advance after another in telecommunications and information processing, orchestrated by transnational corporations determined to develop a seamless global marketplace. National governments have generally converged with the private sector on a market-based ideology that values uniformity and consistency (to deliver products) and devalues variety and uncertainty (as barriers to trade and investment). This is "perhaps the fundamental problem," as Jeffrey McNeely, IUCN's chief biodiversity officer, sees it. The world…

> "has become a single global trading system, bringing new technologies, new approaches and new pressures for exploiting resources,…[overwhelming] resource management measures that local communities had developed from their long experience of surviving in an uncertain world. [These] highly diverse and often localized adaptations to local environmental conditions [are being replaced by] a world culture increasingly characterized by very high levels of material consumption, at least for a privileged minority." (*McNeely 1995*)

COMPARING SPECIES AND LANGUAGES

McNeely is one of a growing number of scientists and conservationists who have begun to analyze biological and cultural diversity in an integrated way. It is not a new approach: comparing species and languages, for example, has a venerable history. In biology, it goes back at least to Charles Darwin, whose enthusiasm is evident both in the *Origin of Species* and *The Descent of Man*, as well as in his praise of Sir Charles Lyell's chapter comparing species and languages in the great geologist's *Antiquity of Man*. This is because the two are fundamental units whose existence and importance seem self-evident. Yet each is hard to define in practice because it is not easy separating discrete from continuous variation at the margins, where species blend into other species (or subspecies) and languages into languages (or dialects). The standard defining criteria—that is, reproductive isolation for species, and mutual intelligibility for languages—explain things quite well in many instances, but neither is authoritative. In nature, there are numerous exceptions to the classic biological species concept; while in linguistics, there are many examples where speech forms considered to be dialects of a single language are mutually unintelligible.

The process governing the formation of species and languages is similarly complex. In most cases, it follows prolonged geographic isolation resulting from the separation of a community of plants or animals or the migration of a community of speakers. Geographic isolation allows for—though does not necessarily produce—reproductive isolation (for species) or communicative isolation (for languages). If they do occur, a new species or language is born (Mayr 1963; Swadesh 1971). Yet sympatric speciation (that occurring in the same area) is common, as are cases of "sympatric" language genesis. Aboriginal Australia is an excellent example where separate languages (over 250) apparently formed without long-term isolation, but rather through cultural interchange. This alternative mode of language development requires a relatively stable social equilibrium to be successful (Mühlhäusler 1995; Dixon 1997).

The elimination of conditions that allow for the isolation of species or languages threatens the continuation of large-scale speciation and language development. Just as the habitats of native flora and fauna are threatened by invasive species, languages can be threatened by disruptions to the cultural and economic settings in which they have evolved. Just as modern transport allows invasive species to travel all over the world, global telecommunications means that economically dominant languages are now heard daily in the remotest regions. Geographic isolation no longer results in either communicative isolation or the stable social equilibrium needed for mutual cultural enrichment.

GAUGING CULTURAL DIVERSITY THROUGH LANGUAGE USE

Cultures cannot be distinguished on the basis of one facet. Nonetheless, broad trends in cultural diversity can be tracked by gauging trends in linguistic diversity, the range of variation exhibited across languages. This is difficult to measure because, as any linguist can tell you, there are vehement disagreements over the taxonomy of the world's languages. So, just as species richness serves as the most common standard of global biodiversity, language richness, or the number of distinct languages in use, signifies linguistic diversity.

Language richness also conveniently indicates cultural diversity as a whole. Not only is language the carrier of many cultural differences (and is considered by many to be emblematic of distinctive world views), it is the best proxy measure because it allows a comprehensible division of the world's peoples into constituent groups. If we could on a single day ask each person on the planet to name his or her native language, the results would be an approximation of the world's cultural diversity at that moment.

Even if this were possible, such a census would not capture the nuances of language use. For example, if "mother tongue" is defined as a person's "first language," then it follows that even a person raised in a bilingual or multilingual household can have only one mother tongue. This may be true in a strict sense, but the daily experience of millions of people includes the equally effective use of two (or more) languages, usually in different spheres: one at home, another at work or the market, perhaps a third at worship, and so forth.

THE PROCESS AND SCOPE OF LANGUAGE EXTINCTION

Such multilingualism may well have been the norm throughout most of history (Grimes 1995); but it likely will not be much longer. Every linguist who has seriously studied the situation believes that large numbers of the world's languages are threatened with extinction in the decades to come. As with species extinction projections, the evidence for this derives not from accurate empirical data, but from extrapolations —in this case, extrapolations from what is known about the process of language extinction among smaller languages for which linguists have obtained detailed demographic information. The crucial question is whether a language is becoming moribund. This occurs when it is no longer being passed on to the younger generations of the speech community. The failure of intergenerational transmission in a language is analogous to the loss of reproductive capacity in a species.

We know that the great majority of indigenous languages in North America are in trouble. Probably 80% of those in the USA are moribund (*Figure 1*) and the general situation in Canada and Mexico is very

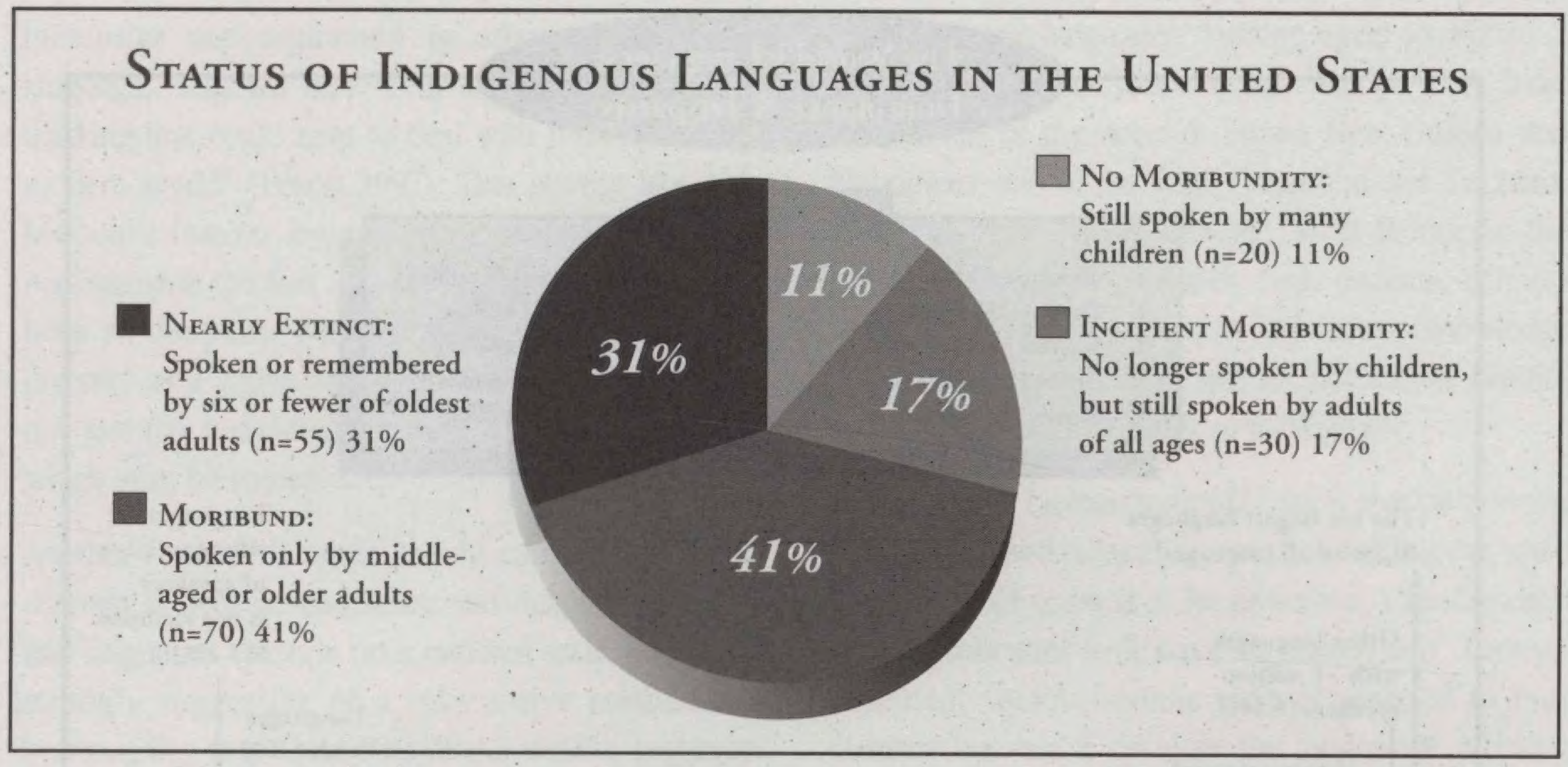


Figure 1
Moribundity in the native languages of the USA. Source: Krauss 1995b.

poor (Kinkade 1991; Garza Cuarón and Lastra 1991). Leanne Hinton's 1994 review of the situation in California paints a typical picture. Of the 50 contemporary indigenous languages in the state (at least 50 others existed before Europeans arrived), more than 15 are recently extinct and many others have fewer than 10 speakers (all elders). Only two or three have as many as 150 or 200 speakers. The pages of linguistic journals, papers presented at conferences, and postings to the ENDANGERED LANGUAGES e-mail list are filled with similar examples. Even in Europe (where EU recognition of language rights is relatively strong compared with the rest of the world), almost every regional language is haunted by incipient or possible moribundity.

To assess the global situation, in a recent paper I analyzed data from *Ethnologue: Languages of the World* (the standard reference) with endangerment factors in mind. The key results, summarized in *Figure 2*, show the status of the world's languages and the dire problems most face. Of the roughly 6,500 living languages listed, the 10 largest account for just under half of the world's population. By contrast, between 3,400 and 4,000 languages (52%-60% of the global total) are spoken by no more than 10,000 people. Most of these are indigenous languages, and they are the mother tongues of roughly 8 million people only, or far less than 1% of the world's population. The overwhelming dominance of the "big ten," the disparity between the great number of small languages and the tiny proportion of the world's population they represent, and the globalization pressures discussed above are the three macro-factors that point to a probable mass extinction of languages in the coming century.

It seems likely that the overall percentage of linguistic extinctions during the 21st century will far exceed current estimates of species extinctions, which put global species loss at 1-10% per decade (Stork 1997; Heywood 1995). Michael Krauss thinks that perhaps 50% of the world's languages are already moribund, and that 20-50% will likely become extinct during the next hundred years, with as many as 90% becoming so moribund as to be committed to extinction. Peter Mühlhäusler believes that more than 95% of all languages are endangered, and RMW Dixon estimates that at least 75% will become extinct. I think it is reasonable to predict that, during the next century, at least 50% of the world's languages will become extinct (or irreversibly moribund) as mother tongues. At worst the percentage could be far higher.

WHY SHOULD BIOLOGISTS CARE?

Why even try to preserve this raft of tiny languages, these relicts of a bygone era which will never be of any economic or political importance, and whose existence was always precarious anyway? Let me try answering with an analogy. A couple of years ago, I was listening to a radio news story about U.S. government efforts to protect grizzly bears in the greater Yellowstone region. The reporter interviewed a local rancher who said, "Why are we wasting money on this? Our grandparents spent a lot of time and effort cleaning bears out of this country so our children, livestock and homes would be safe." The unspoken

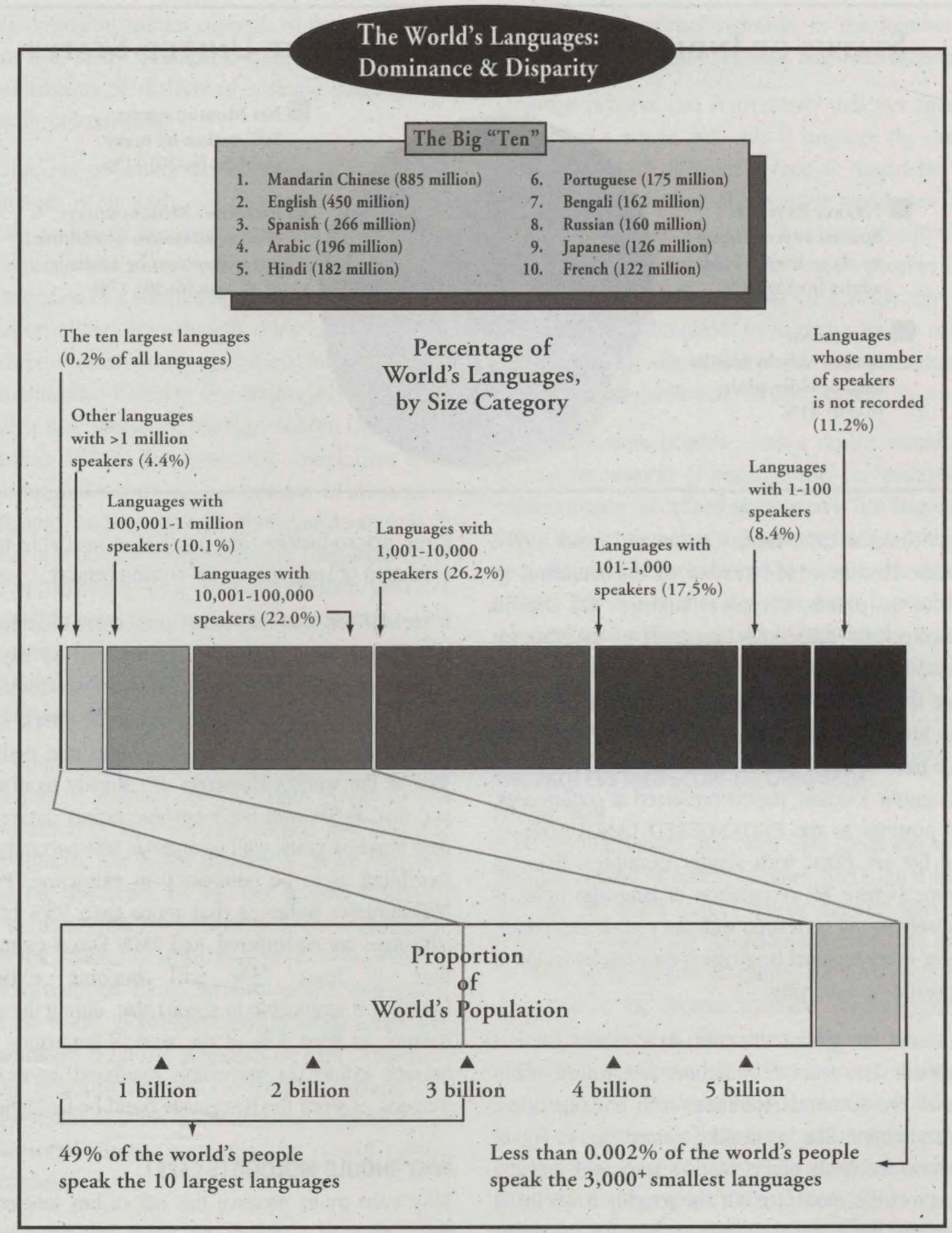


Figure 2
The world's languages: dominance and disparity. Source: Harmon 1995, analyzing data in Grimes 1992.

argument is that free-ranging grizzlies—potentially deadly, with next to no commercial value in comparison with sheep or cattle—are obsolete within the context of a modern, agricultural landscape. The counter-argument is that grizzly bears are important to a vital, intact ecosystem, and the ecosystem is to be valued in its entirety, whatever inconveniences, dangers or economic hardships its individual components may pose to humans.

This is essentially the same argument that must be made for preserving languages and the other components of cultural diversity. Though an individual language may be economically and demographically insignificant on a global scale, each one is a unique expression of human creativity. There is no such thing as a "primitive" language. Modern linguistics shows that "all languages are roughly equal in terms of overall complexity" and that, "by examining the ways meanings are organised in some little-known language," linguists may "evolve some new mode of thinking that could help to deal with problems in the modern world" (Dixon 1997). This is very like Aldo Leopold's famous injunction about natural resource management: the first rule of intelligent tinkering is to keep all the parts. Whether in nature or culture, it is diversity as a whole and the processes that created it, not just the individual products of those processes, which must be valued.

Another reason biologists should care about cultural diversity is because endemism and richness in species and languages coincide on a national scale, and this is strongly suggestive of a substantive relationship between the two. Over 80% of the world's languages are endemic to a single country, and those countries with the highest number of endemic languages are also among the highest in endemic species (*Table 1*). Of the 25 countries with the most endemic languages, 16 are also in the top 25 in endemic vertebrate species, and 12 appear on the list of the 19 countries with the most Endemic Bird Areas as identified by BirdLife International. In addition, 17 are in the top 25 for higher (flowering) plants, including non-endemics. Finally, 10 of the 12 "megadiversity countries" are also among the top 25 in endemic languages.

Three biogeographical principles help explain these patterns of concurrence. First, large countries with highly varied terrain, climate and ecosystems tend to have high numbers of endemic species simply because of their size and biophysical diversity. These same factors, operating at the lower population levels that prevailed before European expansion, also fostered communicative isolation, thus allowing many small autonomous languages to evolve. Second, island countries tend to have higher numbers (and often a high density) of endemics because of their physical isolation from continental land masses. Islands that in addition have broken terrain or some other significant physical barriers to ease of movement also tend to have more endemic languages than similar continental countries. Third, tropical countries tend to have more species than others. These countries also tend to have more endemic languages because their species richness made it possible for small hunter-gatherer bands to flourish before the advent of concentrated agriculture. With these small cultural groups came many endemic languages. Turning again to *Figure 2*, examples of the first factor include Mexico, USA, India and China; of the second, Papua New Guinea and Philippines; and of the third, Cameroon and Tanzania. Where all three factors coincide, as in Indonesia, the possibility exists for extremely high endemic richness in both species and languages. Indigenous knowledge is also a window on those species that science has not yet described taxonomically or ecologically.

A final reason biologists should care is that proponents of biological and cultural diversity are fighting the same battle. If biodiversity is to be preserved, a fundamental shift in attitudes will have to take place. Today's dominant socioeconomic view is inimical to biodiversity because it devalues the total range of biotic variation in favor of the very narrow portions of it that are currently commercially viable. The whole movement to elevate biodiversity to a central place, not just in conservation but in workaday life, depends on getting people to recognize that all living processes and their components are valuable, not just those that happen to be of use to humans. There are models that begin to show the way, but they are found primarily among indigenous peoples whose cultures and languages are threatened by wholesale, unmoderated change.

It is not a question of idealizing indigenous people or of locking them into a bygone lifestyle. Many of them wish to realize aspects of modern life: not just technology, but access to national political institutions, formal education, etc. At present, however, it is next to impossible for tribal people to integrate modern institutions and traditional culture. Instead, they are forced to abandon or repudiate their traditions to gain full access to modern institutions. There is no intrinsic reason why this should be a Hobson's choice. It is possible for modernity to engage bearers of tradition so that the result is additive and accepting rather than annihilating. Consider the hard economic proof offered by the growing popularity of heritage tourism which, at its best, respects the integrity of the host culture without undermining its authenticity. In its motives, heritage tourism is closely allied with ecotourism, and both have the potential to be positive forces on behalf of diversity.

Given the extreme imbalance shown in *Figure 2*, one can fairly ask whether the extinction of large numbers

Table 1
Endemism in language compared with rankings of biodiversity

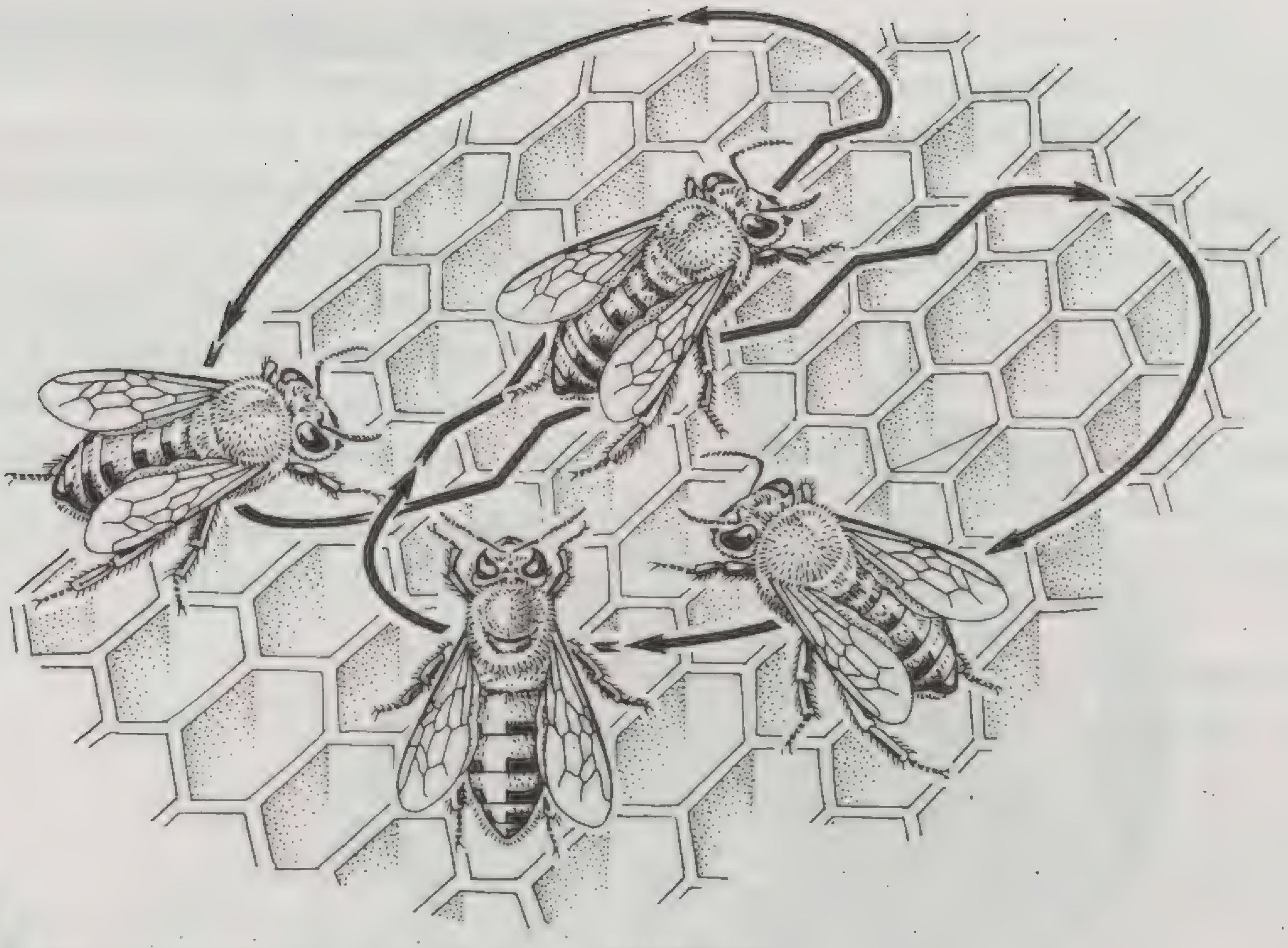
Notes:
Figures for Ethiopia include Eritrea. Endemic vertebrate figures for China, Papua New Guinea, and USA do not include reptiles because the number of endemic species is not reported in the source table. Flowering plant species include both endemics and non-endemics. "Megadiversity countries" have been identified as those likely to contain a large percentage of global species richness. The twelve listed were identified on the basis of species lists for vertebrates, swallowtail butterflies and higher plants.

Sources:
Endemic languages: Harmon 1995, 22-28. Endemic vertebrates: Groombridge 1992, 139-141. EBAs: Stattersfield et al. 1998. Flowering plants: Groombridge 1992, 80-83. Megadiversity countries: McNeely et al. 1990, 88-90.

Country	**Rank, Total Number of...**				**On mega-diversity list?**
	Endemic Languages	**Endemic Vertebrates**	**Flowering Plants**	**Endemic Bird Areas (EBAs)**	
Papua New Guinea	1st	13th	18th	6th	
Indonesia	2nd	4th	7th	1st	*yes*
Nigeria	3rd				
India	4th	7th	12th	11th	*yes*
Australia	5th	1st	11th	9th	*yes*
Mexico	6th	2nd	4th	2nd	*yes*
Cameroon	7th	23rd	24th		
Brazil	8th	3rd	1st	4th	*yes*
Dem Rep of Congo	9th	18th	17th		*yes*
Philippines	10th	6th	25th	11th	
USA	11th	11th	9th	15th	
Vanuatu	12th				
Tanzania	13th	21st	19th	14th	
Sudan	14th				
Malaysia	15th		14th		*yes*
Ethiopia	16th	25th			
China	17th	12th	3rd	6th	*yes*
Peru	18th	8th	13th	3rd	*yes*
Chad	19th				
Russia	20th		6th		
Solomon Islands	21st	24th			
Nepal	22nd		22nd		
Colombia	23rd	9th	2nd	5th	*yes*
Côte d'Ivoire	24th				
Canada	25th				

of languages is inevitable. Some linguists think so, and argue that salvage linguistics—documenting languages before they disappear—is the only useful thing that can be done (Dixon 1997). But more endangered-language communities increasingly are refusing to accept this. There are language retention and rejuvenation activities popping up all over the world. In New Zealand, children can take part in Maori immersion programs. In California, a master-apprentice program pairs elder speakers with younger learners of the remaining native languages of the state (Hinton 1994). In the Hebrides and Highlands, speakers of Scottish Gaelic have formed Comann an Luchd Ionnsachaidh, an adult learner's society. In Botswana, organizations support Shiyeyi, Ikalanga and other tribal languages by publishing workbooks and holding classes. Several new international nongovernmental organizations also have taken up the cause of linguistic diversity.

The enactment of Article 8(j) of the Convention on Biological Diversity is one of a growing number of international activities that adopts a biocultural perspective. Article 8(j) calls for preserving, maintaining and promoting the "knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological



The waggle dance of the honey bee, *Apis mellifera*, communicates the distance and direction of a food source.

Illus.: Roelof Idema

diversity." While the implementation of 8(j) is still decidedly a work in progress, the article's very existence, and the fact that indigenous representatives are taking an active role in shaping it, are highly significant.

The dawning of a biocultural approach signals a new chapter in humankind's age-old fascination with diversity. Luisa Maffi is a linguistic anthropologist and president of Terralingua, a new international organization dedicated to integrating the understanding and protection of linguistic, cultural and biological diversity. She has observed that "questions about the consequences of loss of linguistic and cultural diversity have been raised mostly in terms of ethics and social justice, and of maintaining the human heritage from the past—and rightly so....

> "However, when we consider the interrelationships between linguistic, cultural, and biological diversity, we may begin to ask these questions also as questions about the future—as related to the continued viability of humanity on earth. We may ask whether linguistic and cultural diversity and diversification may not share substantive characteristics with biological diversity and diversification, characteristics that are ultimately those of all life on earth."

Maffi is asking the right questions, because the answers will help to determine the fate of Earth's living variety in the years to come.

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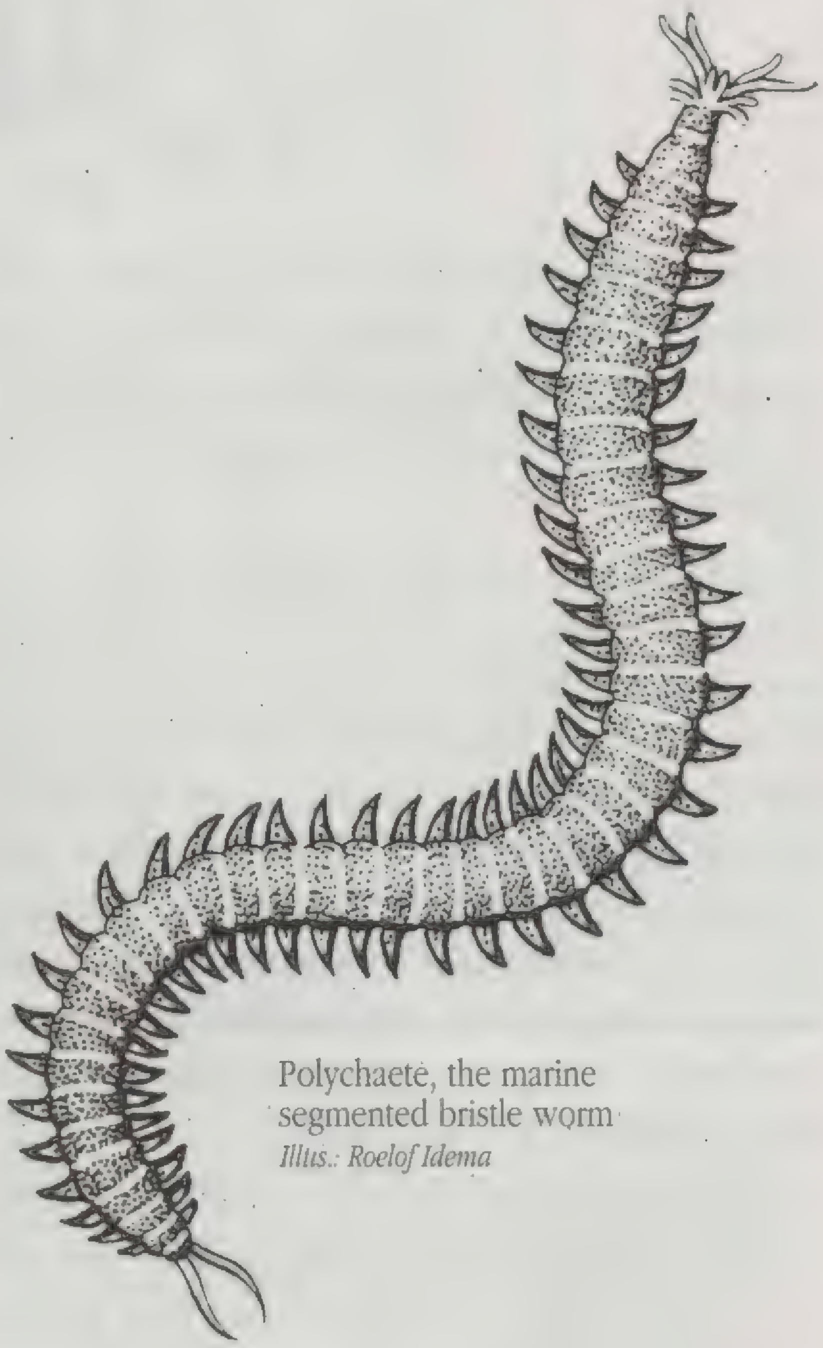
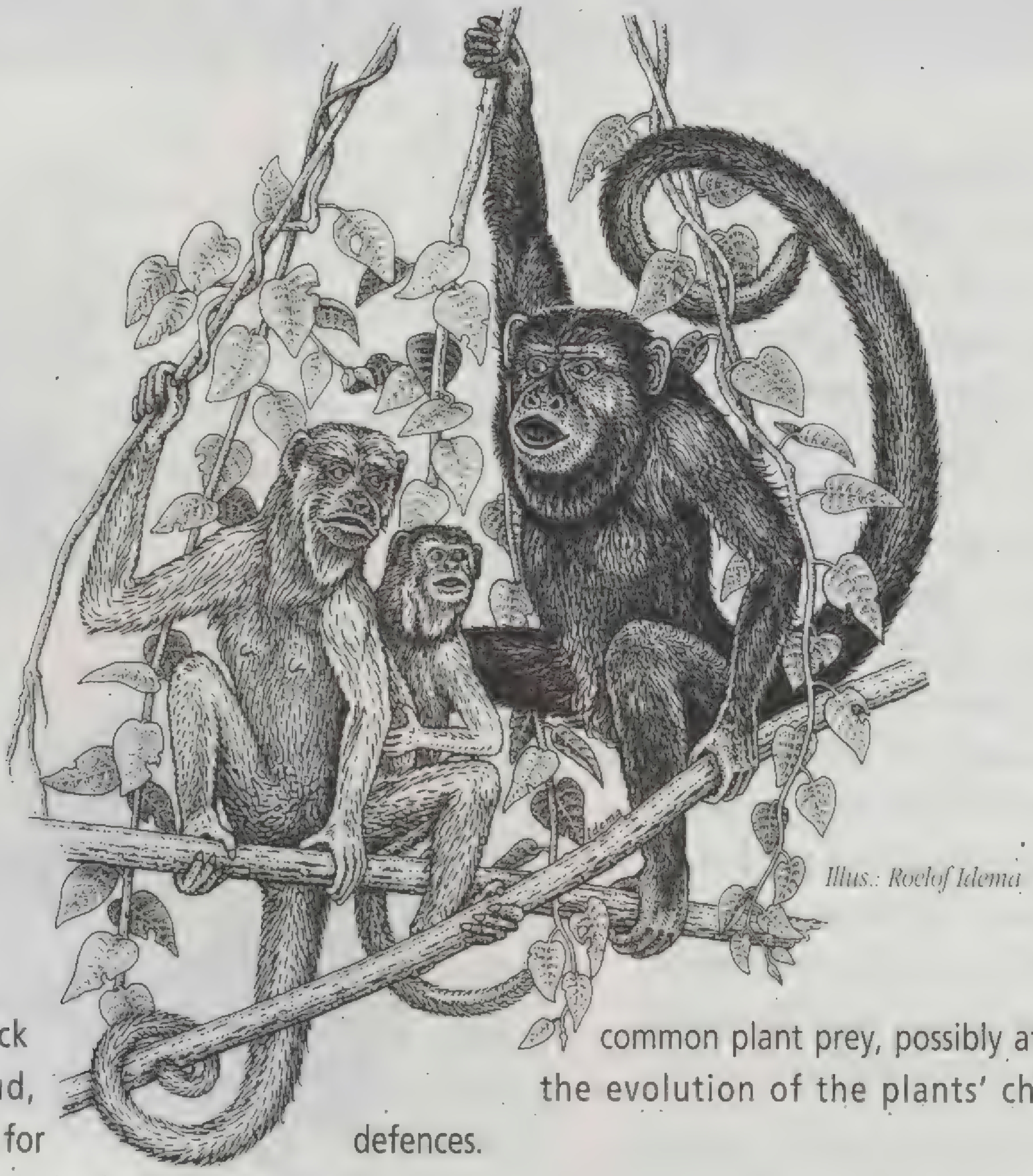


Polychaete, the marine segmented bristle worm
Illus.: Roelof Idema

PORTRAIT OF BIODIVERSITY

Black howler monkey

Alouatta pigra



Illus.: Roelof Idema

The black howler monkey, *Alouatta pigra*, is a large primate found in Mexico, Guatemala, Belize and possibly, northern Honduras. One of six to nine species of the genus *Alouatta*, *A. pigra* is monotypic.

As their name suggests, the black howler adult males make loud, sonorous howls that can be heard for more than two kilometres through the forest. These calls are thought to establish home ranges among groups, thus minimizing conflict where groups are likely to encounter one another. The howlers' social experience is dynamic. Communication is primarily vocal, and there is a continual exchange of auditory and visual signals as individuals jockey for position in relation to critical resources, such as food, mates and space.

A. pigra live in a variety of tropical habitats from tropical wet to deciduous. They eat nutritious new leaves, flowers and fruits when these are abundant, and consume mature leaves to supplement their diets during periods of food stress. Their varied diets allow black howlers to occupy a broad range of habitats. Recent studies suggest that seed dispersal by herbivorous mammals may significantly influence forest architecture. Thus, black howler monkeys may affect patterns of plant distribution and abundance within their habitats, and may have co-evolved with their common plant prey, possibly affecting the evolution of the plants' chemical defences.

Judged to be at a low risk of extinction throughout its range, the monkeys may be locally endangered or extinct. In Belize for example, black howlers have suffered local extinctions due to disease, habitat destruction and hunting, leading the American primatologist Robert Horwich to start recovery efforts in the late 1980s. Horwich and his colleagues translocated monkeys to areas in which they had become extinct due to deforestation and yellow fever. Initiating work in Bermudian Landing, a small creole village northwest of Belize City, Horwich established the Community Baboon Sanctuary, an eco-tourism project involving small landowners pledging to preserve howler habitat. In return, the residents have benefited economically from the businesses sustained by low-impact tourism, such as a vistors' centre and museum.

Clara B. Jones, PhD
Department of Psychology,
Livingstone College, Salisbury, North Carolina, & Community
Conservation Consultants, Gays Mills, Wisconsin, USA

BIODIVERSITY NEWS

BIRDS HELP BRITAIN MEASURE QUALITY OF LIFE

The British government has unveiled plans to measure quality of life using such factors as the wild bird population in an attempt to establish whether life in Britain is getting better or worse. "The quality of life is not simply economic," Deputy Prime Minister John Prescott, head of a giant ministry in charge of environmental, transport and regional policy, told a news conference in November. Prescott said he wanted to see new official statistics introduced next year to put alongside traditional economic measures.

As well as looking at how Britain's feathered friends are prospering, these new measures would chart progress in areas such as housing and water quality, air pollution, greenhouse gas emissions, traffic volumes, educational achievements and health, he said. Prescott said Britons were used to judging the economy's performance on the basis of economic growth, inflation and employment figures. "I want these [new] indicators over time to become just as useful and familiar, reported regularly on TV, radio and in the newspapers," said Prescott, who played a key role in getting agreement on curbing greenhouse emissions at the Kyoto world environment summit. The government plans annual publication of most new indicators, which Prescott said would show an example to the world of how to take environmental concerns into account.

Prescott's plans will now go out to public consultation before being implemented. Environmentalists gave them a cautious welcome, but said the crunch would come once the indicators showed a deteriorating picture. "The key question then becomes: 'Are they (government) going to change their economic policies to protect the environment?'," Charles Secrett, director of the Friends of the Earth pressure group, told BBC radio. "And we doubt that very much." [Condensed from Reuters Limited 1998]

Hooded warbler, *Wilsonia citrina*, at risk in Canada

Illus.: Roelof Idema

CONSUMER BOYCOTTS RULED LEGAL AND PROVEN EFFECTIVE

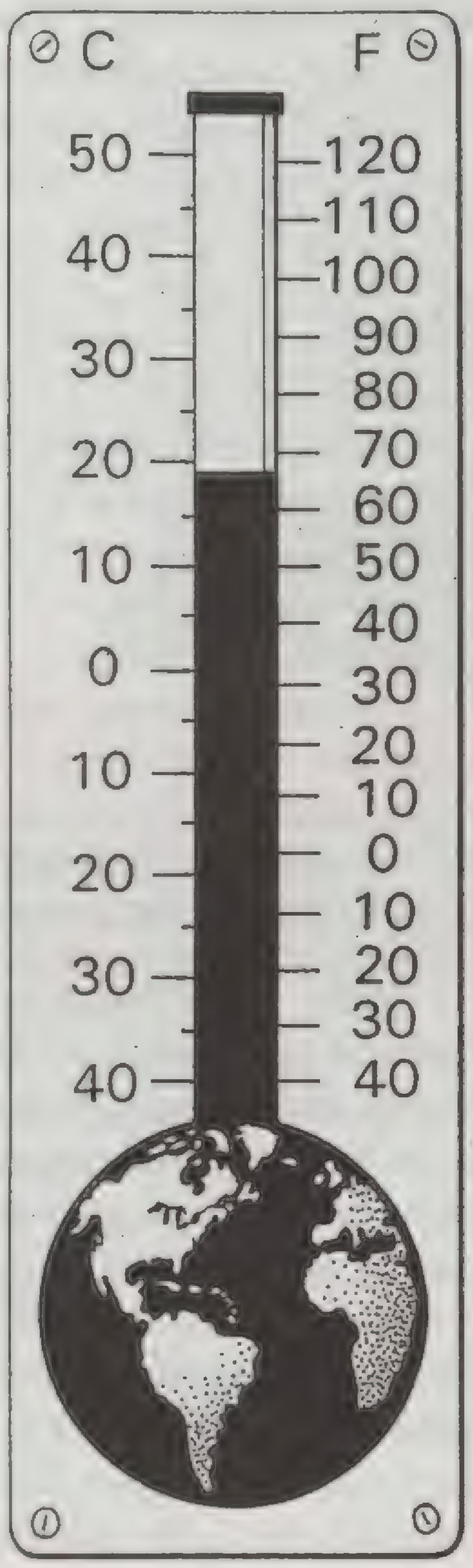
In a landmark ruling by the Ontario Court earlier this year, a consumer boycott, launched by Toronto-based Friends of the Lubicon against multinational Daishowa paper company, was ruled legal and "a model of how such activities should be conducted in a democratic society." Subsequently, Daishowa capitulated to the seven-year campaign to stop logging in the 10,000 square kilometres of land claimed by the Lubicon (Cree Nation of northern Alberta) who are still in land negotiations with provincial and federal governments. At issue was the ability of corporations to use the courts to silence public debate on matters of public interest involving the corporation's activities. Four years into the boycott, Daishowa sued, claiming the boycott was an "intentional interference with economic relations of Daishowa and should be restrained by the courts." In dismissing Daishowa's plea for a permanent injunction against the boycott, Mr. Justice James MacPherson observed that the protection of the Canadian Charter of Rights and Freedoms must be extended to protect political expression on issues of public importance. [Condensed from *Natural Life*, July/August 1998]

SWEDISH BUDGET ALLOCATES MORE TO ENVIRONMENT

Sweden's government has announced it is allocating more money—a total increase of 759 million Swedish crowns—to protect the environment, particularly forests. An additional 660 million crowns will be made available to protect biological diversity between 1999 and 2001, the finance ministry said in its October budget statement. Another 99 million will go towards conservation agreements and biotype protection in forests, along with advice and information for forest users. A total of 170 million Swedish crowns will also be made available over a three-year period for land decontamination, the finance ministry said. It did not say whether this amount was an increase over an allocation made in the April budget. [Condensed from Reuters Limited 1998]

NEW STUDY SHOWS EFFICIENT ENERGY CAN REDUCE EMISSIONS AND SAVE MONEY

A new study by the American Council for an Energy-Efficient Economy (ACEEE) shows how the US can achieve over 60 percent of the carbon emissions reduction required to meet the Kyoto Protocol target. Entitled "Approaching the Kyoto Targets: Five Key Strategies for the United States," the study outlines five approaches for action that will also save money for consumers and businesses. These initiatives are meant to stimulate widespread energy efficiency improvements in all sectors of the American economy:



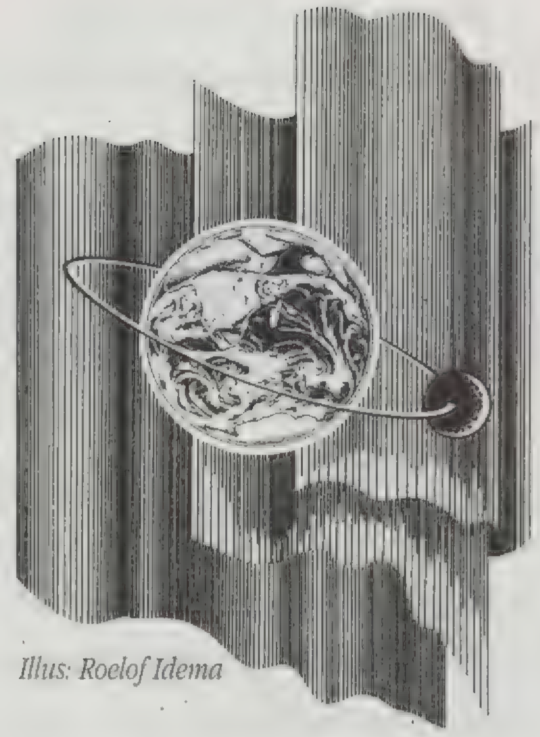
Illus.: Roelof Idema

- new appliance and equipment efficiency standards and related voluntary programs;
- public benefit trust fund as part of electric utility industry restructuring;
- fuel economy standards and market incentives to improve vehicle fuel economy;
- removing barriers inhibiting greater use of combined heat and power systems; and
- power plant efficiency standards.

"These five initiatives could cut U.S. carbon emissions in 2010 by 310 million tons per year—17 percent of the emissions expected in 2010 given business-as-usual trends and policies—while actually saving consumers money. The emission reductions could nearly double by 2020 as efficiency improvements continue to be made and more appliances, buildings, vehicles and power plants are replaced," said Howard Geller, ACEEE executive director and co-author of the study. "Leaders should realize that meeting the Kyoto Protocol is feasible and need not harm the national economy," Geller concluded. For copies, contact the ACEEE publications office at (tel.) 202-429-0063 or (e-mail) ace3pubs@ix.netcom.com. [Condensed from *The Gallon Environment Letter* 2(26)]

COELACANTH DISCOVERED IN INDONESIA

A coelacanth, a living fish fossil, has been discovered in Indonesia, 7,000 km east of its previously known range, according to *Nature* magazine (September 1998). Mark Erdman, a University of California-



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Berkeley biologist, and his wife discovered a coelacanth in the fish market in Manada, Sulawesi, Indonesia. They were told of the significance of their find by Drs. David Noakes and Eugene Balon of Guelph University, Ontario. Fishers then brought in a second, 1.2 m-long specimen to Erdman in late July 1998. He took photos, sampled DNA and preserved the dying specimen.

Sixty years ago the first known living coelacanth, *Latimeria chalumnae*, was caught off South Africa. This astonished the world since coelacanths were only known from fossils 80 million or more years old. The species was of great interest because it was thought to belong to the group that gave rise to land-dwelling vertebrates, a position now accorded by many to the lungfishes.

The scientist J.L.B. Smith tracked the species along East Africa to what was then considered its true home, the Comores Archipelago, lying between Africa and Madagascar. Recent work has shown there may be only 300 surviving specimens of the coelacanth in the Comores, now red-listed as endangered. The extension of the range to Indonesia gives hope that the species, declining in the Comores, may yet survive. For more on coelacanths, go to CMN's web site at <http://www.nature.ca/english/treasures/trsite/treas.html> or order the CMN booklet entitled "Old Fourlegs: A 'Living' Fossil" by Don McAllister. ISBN 0-660-02000-9.

CORNELL UNIVERSITY FINDS 40% OF DEATHS CAUSED BY POLLUTION AND ENVIRONMENTAL FACTORS

Forty percent of deaths worldwide are caused by pollution and other environmental factors, and climate change will make matters worse, Cornell University scientists found in a study released in September 1998. After studying population trends, climate change, increasing pollution levels and emerging diseases, graduate student researchers led by Cornell ecology professor David Pimentel concluded that human inability to control their own pollution is killing them. They also found that increased temperatures caused by climate change will lead to a new round of deaths and injury related to extreme weather events and tropical diseases moving north. They reported their findings in the *BioScience Journal* (October 1998).

The study group found that millions of people would become "environmental refugees," forced to flee their home areas to search for fuel, building materials and food. Researchers anticipate that over-population and crowding in villages and cities will lead to the reemergence of deadly diseases like the plague. They also found that each year air pollutants adversely affect the health of 4-5 billion people, and the trend looks likely to worsen with the number of automobiles growing three times faster than the rate of population growth. For more information, contact study coordinator, Dr. David Pimentel at (e-mail) dp18@cornell.edu. [Condensed from *The Gallon Environment Letter* 2(26)]

ESCAPED ATLANTIC SALMON REPRODUCE IN WEST COAST RIVER

The discovery of young Atlantic salmon in a British Columbia river, progeny of escapees from aquaculture stocks, raise fears that this alien species may displace some of the five species of valuable native Pacific salmon. The young Atlantic salmon were found in the Tsitika River, 140 km north of Campbell River on Vancouver Island by a provincial fisheries monitoring crew. Twelve juveniles were captured, four of which were retained. Scale analysis revealed they were not of domestic stock, indicating reproduction had taken place in the wild. Environmentalists have been voicing concern that some of the 60,000 Atlantic salmon escapes annually from some 80 fish farms might become established in West Coast rivers.

Jim Fulton, executive director of the David Suzuki Foundation said, "We have a crisis in ... Pacific salmon stocks. There has been a near total ban on coho fishing on the B.C. coast this year, and clearly scientists ... are concerned that when you get low numbers of wild stocks, that's when you ... see Atlantics escaping and colonizing the ... habitat." The Foundation has called for a closure of all open-net fish farms, the only type used in B.C., by December 31, 1999 and for a stop to imports of Atlantic salmon eggs into Canada. [Condensed from the *Vancouver Sun* (Sept. 23, 1998) and forwarded by the Georgia Strait Alliance.]

Related news: See the new report commissioned by the David Suzuki Foundation entitled *Taking Our Breath Away: The Health Effects of Air Pollution and Climate Change* released in October 1998. Contact: (e-mail) solutions@davidsuzuki.org / (tel.) 604-732-4228.

Milanji cedar, *Widdringtonia whytei*, of East Africa
Illus.: Roelof Idema

U.S. MOVES TO TEST EFFECTS OF COMMON CHEMICALS

The U.S. Environmental Protection Agency (EPA) moved closer to starting a screening program on the health and environmental effects of common chemicals used in a range of products from pesticides to plastics. Based on recommendations of a scientific advisory board, the EPA initiated a program to identify and characterize chemicals known as "endocrine disrupters." Some scientists suspect that such chemicals cause birth defects, breast cancer, prostate cancer and infertility in humans. Endocrine disrupters have already been proved to result in developmental and reproductive abnormalities in wildlife.

The EPA will initially focus on 15,000 chemicals, produced in volumes exceeding 10,000 pounds (4,536 kg) per year, and for which test data is limited. The World Wildlife Fund praised the EPA decision and urged the agency to push for full implementation of the screening program with complete funding and "realistic criteria, procedures and priorities." [Condensed from Reuters Limited 1998.]

INDIA CREATES SOCIETY FOR ECOLOGICAL ECONOMICS

The Indian Society for Ecological Economics (INSEE) was launched in Delhi in September, bringing together economists, ecologists and senior policy analysts. As the India chapter of the International Society of Ecological Economics, the Society will promote research on the integration of economics and ecology, develop policy for sustainable development at the regional, national and global levels and strengthen interdisciplinary discourse between and within the natural and social sciences. Contact: Prof. Kanchan Chopra, Institute of Economic Growth, University Enclave, Delhi, India, 110007 / E-mail: kc@ieg.ernet.in. [Condensed from *The Gallon Environment Letter* 2(26)]

SEND US YOUR VIEWS

The Canadian Museum of Nature is pleased to provide an open forum for diverse viewpoints even though they may not represent the views of the Museum itself.

Comments on articles in *Global biodiversity* and any biodiversity issues are welcomed.

Anonymous contributions will not be published.

Please note: by sending in your views, you give the Canadian Museum of Nature permission to publish your views on our website **<http://www.nature.ca/english/gbfor.htm>** and/or in *Global biodiversity* magazine.

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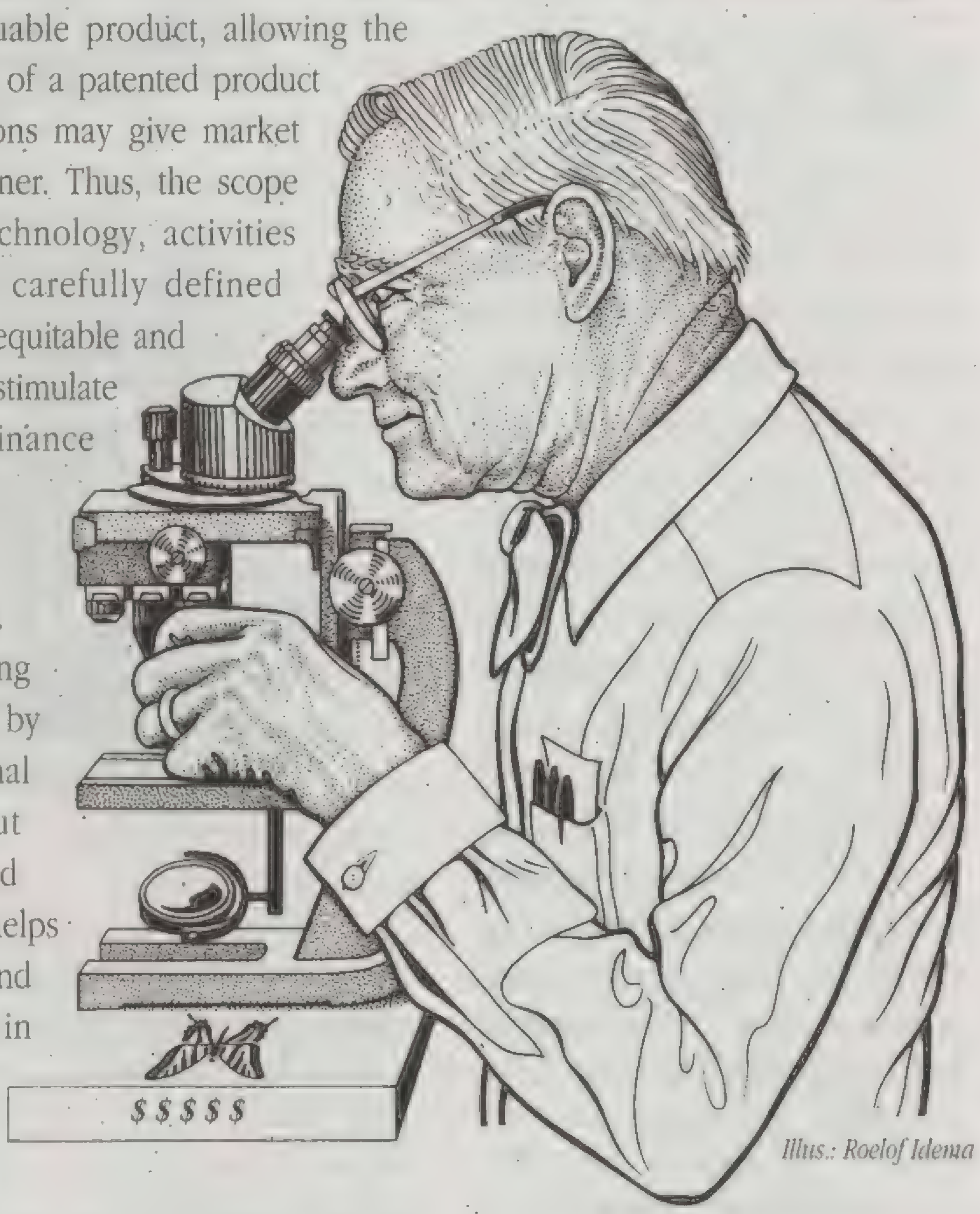
FORUM

Intellectual property rights on the block

WTO needs advice from citizens' groups on patents over life

by David R. Downes and Matthew Stilwell, Center for International Environmental Law (CIEL)

Inventors and creators gain patents or copyrights—intellectual property rights—as a reward for innovation and an incentive to disclose information to the public, thus promoting innovation by others. Intellectual property is widely recognized as an essential policy tool in market economies. The legal right is a time-limited exclusive right to control commercial use and sale of a valuable product, allowing the holder to raise the price and reduce supply of a patented product available to consumers. Patents on inventions may give market dominance or even a monopoly to the owner. Thus, the scope of exclusive rights—in terms of time, technology, activities and geographical application—must be carefully defined to maximize the benefits to the public. An equitable and creative society must balance its interests to stimulate innovation, avoid excessive market dominance and maximize access to and exchange of information.



Illus.: Roelof Idema

Today, the balance seems to be shifting. Intellectual property laws are defined during closed international negotiations dominated by industry. They are then brought to national legislatures as "faits accomplis", without democratic deliberation. The technical and arcane nature of the IPR legal specialty also helps corporate interests to avoid public scrutiny and expand their control over developments in electronic information, biotechnology or pharmaceuticals. Industrial countries promote corporate interests through expanded IPRs in the name of national competitiveness in a global marketplace. The resulting boon to private investors, achieved in part through trade agreements administered by the World Trade Organization (WTO), has been called an "information land grab."

The WTO should be open to public scrutiny and input during the upcoming intellectual property debates. The WTO's 1999 review will focus on whether to require its members to recognize patents on life forms, followed by a second debate in 2000 on all WTO rules on intellectual property. If governments include intellectual property on the agenda for coming trade negotiations, that would make up the third discussion.

1999 "TRIPS REVIEW" OF LIFE PATENTING

Life patenting will come up in 1999 under the WTO Agreement on Trade-Related Aspects of Intellectual Property (TRIPS). Are living organisms or parts of organisms, such as genes, to be considered "inventions" that can be patented under intellectual property law? Life patenting raises concerns about consumer rights, biodiversity conservation, environmental protection, sustainability of agriculture, indigenous rights, scientific and academic freedom, and the economic development of countries dependent on new technologies. Negotiated in the Uruguay Round of trade talks, the current TRIPS Agreement is the most important international law on intellectual property. It sets minimum standards and enforcement procedures for national protection of IPRs. Its enforcement measures—including trade sanctions against non-complying WTO members—are unprecedented in international intellectual property law.

The TRIPS Agreement [Article 27.3(b)] requires countries to recognize patents on most products and processes, including pharmaceuticals, modified microorganisms and "microbiological processes". Currently, however, it does not require countries to recognize patents on plants or animals, or "essentially biological [but not microbiological] processes for the production of plants or animals." Each country has the discretion whether to recognize these patents. Countries may protect plant varieties either through patents or an "effective sui generis system" or both. This exception exists because many other countries rejected the American demand for patenting of plants and animals, on economic, legal or ethical grounds.

The TRIPS Council of the WTO will review Article 27.3(b) of the Agreement next year. It is expected that the United States will seek to remove this discretion and require countries to recognize patents on plants and animals. Other industrialized countries may side with the U.S., especially since the European Union recently extended patents to cover life forms. Many developing countries, however, are likely to oppose the removal of the exception.

WTO SHOULD MAINTAIN THE LIFE PATENTING EXCEPTION

It is our view that the WTO members should resist the proposed extension of TRIPS to life patenting and maintain the current language of Article 27.3(b), allowing for plant and animal discretion and the right to develop sui generis systems for plant variety protection. Members should also consider expanding the exception to cover microorganisms.

This discretion is essential for a number of reasons:

1. *Maintaining flexibility to address indigenous and biodiversity goals.* It gives countries the space they need to experiment with various approaches to implementing Article 8(j) of the Convention on Biological Diversity, requiring protection of traditional knowledge, innovations and practices of local and indigenous communities. Requiring all countries to uniformly recognize life patenting and uniform systems of plant variety protection, would hinder countries from gaining the experience needed to implement Article 8(j) effectively.

2. *Avoiding trends toward overly broad biotechnology patents.* Biotechnology patents are frequently too broad, and can stifle rather than stimulate innovation. Even industry groups in the U.S. have opposed some extensions of rights sought in recent patent applications. This suggests that a "wait-and-see" approach is best.

3. *Maintaining competitive markets.* While the WTO provides powerful protection of intellectual property through TRIPS (permitting members to take "appropriate measures" to prevent abuse of IPRs or practices that restrain trade), there are no international competition rules to guard against market abuses. It should certainly not expand intellectual property requirements until a counter-balancing effort on competition is underway.

4. *Preventing greater disparities between North and South.* The proposed extension of TRIPS to life patenting would further unbalance the Uruguay Round bargain in favor of industrialized countries and against developing countries. The protection afforded by the TRIPS agreement expands exclusive intellectual property protection in time (from 17 years in the U.S. to 20 years under TRIPS); in scope (the TRIPS Agreement covers "any invention"); and in geographical application (to all WTO member countries). The increase in prices that will result from recognition of patents on products such as pharmaceuticals will reduce access for poor people in the developing world.

Mahogany tree
Swietenia mahoganii
Illus.: Roelof Idema

5. *Managing investment in biotechnology.* Countries may not want expanded IPRs until a proper regulatory framework is in place to control its environmental impacts. By definition, intellectual property rights are designed to encourage private sector investment in technological development. Hence, avoiding the extension of intellectual property to modified organisms remains a reasonable policy choice for countries until an effective biosafety protocol is negotiated and enters into force, and effective national regulations and institutions are in place.

6. *Counterbalancing unilateralism on intellectual property.* The WTO should not raise TRIPS standards while major trading nations are applying unilateral pressure to force trading partners not only to meet TRIPS standards but to go beyond them. For instance, the U.S. threatened Argentina with trade sanctions on the grounds that Argentina's protection of IPRs is not strong enough. Yet some of the U.S. demands seemed to seek stronger protection than TRIPS requires.

7. *Addressing environmental and ethical concerns.* Many countries are concerned that patents on crop varieties augment incentives in favour of monocultures and use of expensive inputs such as fertilizer, that in turn harm the environment. Many people in many societies feel that the structures of genes, animals or plants—the structure of life itself—should not become commodities in market transactions, as an ethical matter. The WTO should not adopt a blanket rule when so many perspectives and concerns are yet to be considered.

WTO SHOULD EXAMINE BROADER CONCERNS ABOUT INTELLECTUAL PROPERTY

As Lester Thurow wrote recently in the *Harvard Business Review* (1997), "It is clear that the invention of a new gene for making human beings different or better cannot be handled in the same way as the invention of a new gearbox." Decisions about the evolution of intellectual property cannot be left for specialists or closed international organizations. They need debate by a full range of institutions, experts and representatives of civil society.

As steps toward such a movement, we recommend the following:

- A full and public discussion within the TRIPS Council and the 1999 WTO Ministerial Conference of the public interest questions raised by intellectual property.
- A commitment by WTO members to discuss fully and openly the public interest concerns involved in intellectual property, and to carry out a thorough review of the TRIPS Agreement in 2000, before starting negotiations on additional intellectual property requirements.
- A commitment in the WTO to address related issues alongside intellectual property policy.
- Involvement of other relevant institutions, such as UNESCO, World Health Organization, World Intellectual Property Organization, and the full participation by citizens' groups.

Contact: Center for International Environmental Law; B.P. 21 (160a Route de Florissant), CH-1231 Conches, Geneva, Switzerland; *Tel / Fax:* +41 (22) 789-0738 / *Direct e-mail:* ddownes@igc.apc.org / *Organizational e-mail:* cielus@igc.apc.org / *Web:* http://www.econet.apc.org/ciel/

Adapted from: David R. Downes and Matthew Stilwell. 1998. The 1999 WTO Review of Life Patenting Under TRIPS: Revised Discussion Paper. Washington: Center for International Environmental Law (CIEL). A reference list that accompanied this article is available from *Gb's* managing editor or from the author.

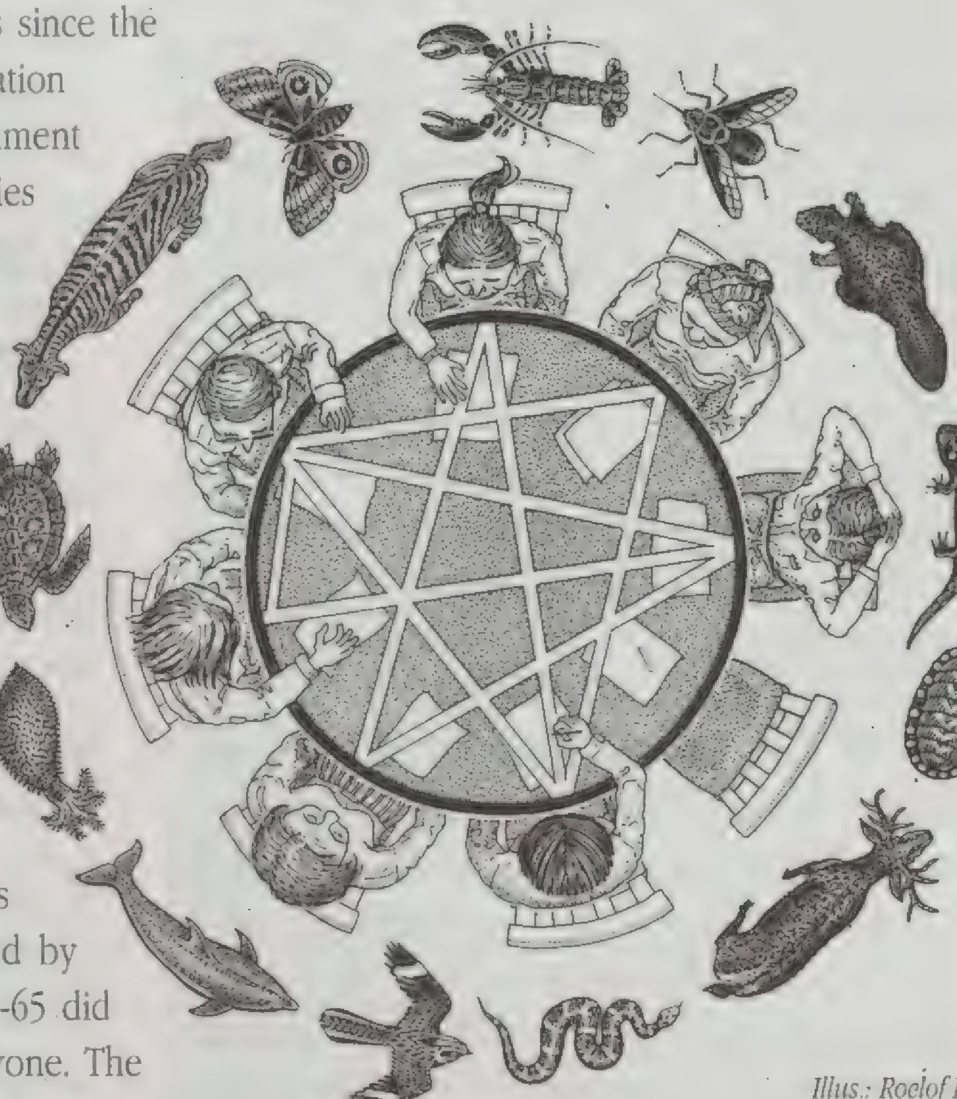
SUCCESSES & INITIATIVES

Unlikely allies join to protect Canada's species at risk

Lessons for working together

by Rita Morbia and Elizabeth May, Sierra Club of Canada

As the planet faces the greatest extinction crisis since the time of the dinosaurs, Canada still has no legislation to protect species at risk. The federal government implicitly made a commitment to protect species when Prime Minister Mulroney signed the United Nations Convention for the Protection of Biological Diversity in June 1992; yet, nothing was done for years to act on that promise.



Illus.: Roelof Idema

In the fall of 1995, Environment Minister Sheila Copps began the legislative process to protect endangered species in Canada. The result, Draft Bill C-65, was tabled by her successor, Sergio Marchi, on October 31, 1996. With this bill, we should have been well advanced in protecting the myriad species imperiled by human activity, a goal supported by 94% of Canadians at the time. Unfortunately, C-65 did not move us forward and alienated almost everyone. The legislation appeared too tough to natural resource users, compromising their concern over the plight of species, while it did very little to protect anything. The bill was an odd combination of being weak and belligerent, ineffectual yet bullying.

Called "An Act respecting the protection of wildlife species in Canada from extirpation or extinction," the bill would have been worse than no law at all, according to many environmentalists. It applied only to species on federal land ("federal species"); its listing process could be tempered by political discretion; and, no provisions were included for protecting the critical habitat of species at risk. Industry representatives, foresters, farmers and fishers were vehemently opposed to it as well, for very different reasons. They were convinced that sections of the Act were too strong, penalties too high, civil suits against accidental harm to species at risk too easily implemented, and habitat protection too threatening to industrial activities. They were afraid of C-65's unbearable economic costs.

In May 1997, when the federal government called an election, Bill C-65 died on the order paper. The issue re-emerged in early 1998, and the government began consultations on protecting species at risk in an atmosphere of

The SARWG document is available from any member of the Species at Risk Working Group listed below. We urge you to call for effective endangered species legislation by writing to the Honourable Christine Stewart, Minister of the Environment, 10 Wellington, Hull, QC K1A 0H3.

- Catherine Austen, Canadian Nature Federation, 1 Nicholas Street, Suite 606, Ottawa, Ontario K1N 7B7. Tel.: (613) 562-3447 / Fax: (613) 562-3371 / E-mail: causten@cnf.ca
- Sandy Baumgartner, Canadian Wildlife Federation, 2740 Queensview Drive, Ottawa, Ontario K2B 1A2. Tel.: (613) 721-2286 / Fax: (613) 721-2902 / E-mail: sandyb@cwf-fcf.org
- Robert Décarie, Canadian Pulp and Paper Association, 1155 Metcalfe Street, Montréal, Québec H3B 4T6. Tel: (514) 683-9996 / Fax: (514) 683-7362 / E-mail: rdecarie@dsuper.net
- Sheila Forsyth, National Agriculture Environment Committee, 75 Albert Street, Suite 1101, Ottawa, Ont. K1P 5E7 Tel.: (613) 237-5833 / Fax: (613) 236-5749 / E-mail: naecfors@magi.com
- Giséle Jacob, The Mining Association of Canada, 350 Sparks Street, Suite 1105, Ottawa, Ontario K1R 7S8. Tel.: (613) 233-9391 / Fax: (613) 233-8897 / E-mail: gjacob@mining.ca
- Elizabeth May, Sierra Club of Canada, 1 Nicholas Street, Suite 412, Ottawa, Ontario K1N 7B7. Tel.: (613) 241-4611 / Fax: (613) 241-2292 / E-mail: sierra@web.net
- Rita Morbia, Sierra Club of Canada, 1 Nicholas Street, Suite 412, Ottawa, Ontario K1N 7B7 Tel.: (613) 241-4611 / Fax: (613) 241-2292 / E-mail: sierra@web.net
- Tony Rotherham, Canadian Pulp and Paper Association, 1155 Metcalfe Street, Montréal, Québec H3B 4T6 Tel.: (514) 866-6621 / Fax: (514) 866-3035 / E-mail: trotherham@cppa.ca

extreme distrust. As well, many who had worked on the issue for years were simply tired. They had heard the same arguments over and over during the previous bill's passage through the House. Although the federal government assured everyone that Bill C-65 had died, its phantom loomed large. It was time to move forward in enacting federal legislation, but no one was sure how to do so in such a divisive atmosphere.

At this time, the Species at Risk Working Group (SARWG) came together. SARWG is an informal gathering of individuals outside government (not representatives of sectors) who have a deep concern for species at risk and a desire to work positively, proactively and creatively to address the issue. Each of us were alerted by the imminent reintroduction of federal legislation for protecting species and wanted to improve on earlier efforts by developing a new, pragmatic and cost-effective approach that would protect species and habitats. Our collaborative approach has allowed us to explore new ideas and find common ground.

SARWG grew out of workshops organized by the Agriculture Environment Committee in fall 1997, where, for the first time, farmers met for a full day with environmental activists. Committee coordinator Sheila Forsyth presented us with a steep learning curve. As environmentalists, we were struck by the hostility of many participants to endangered species legislation. In order to protect species at risk, it was not enough to have a piece of paper calling for it. We had to understand how people on the land would react. Bill C-65 had made farmers, who would ordinarily volunteer to assist with species recovery, grim and sarcastic, joking about shooting endangered species to avoid the impact of legislation. Their perception of C-65 was that it would criminalize everyday activities on their own land. From that experience, we began to wonder how to fix the mess created by C-65.

Sheila Forsyth and Elizabeth May decided to take a risk and invite others (who had scars from the last round of consultations, taskforces and committee hearings) to join a discussion on collaborative effort. To our surprise, a broad cross-section of people came from environ-mental and conservation groups as well as three large industry sectors. We decided to meet for as long as it felt productive. We had no mandate, and no pressure to conform to a particular agenda. We were not officially sanctioned by the government, or any company or organization as stakeholders, and thus were free from expectations to act strictly in the interests of our respective sectors.

We developed some ground rules for the SARWG meetings:

1) "Thinking out loud" was encouraged. No one would be held to what they said as a firm position.

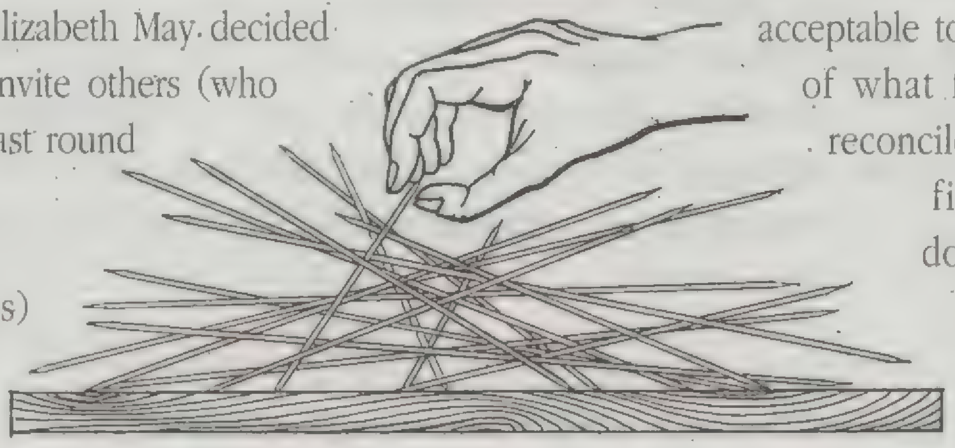
2) Problem-solving involved respectful listening. We asked each other what was the real "problem" with various propositions, what would work to protect species at risk.

3) We had to have fun. (This is a truly heretical principle for this sort of effort, impossible in the government context.) If it stopped being fun, we would not come.

SARWG's efforts focused on producing a document that would encompass the key elements of good species at risk legislation. Several principles guided our work:

- legislation should actually work to protect species at risk;
- all Canadians have a stake in preserving endangered species, so costs should be distributed equitably; and
- socioeconomic impacts should be considered during recovery efforts.

Initially, we were unsure of what the final product would look like, or frankly, if there would be a final product. However, we saw that even the most contentious issues could be dealt with in a manner acceptable to all parties. After eight months of what felt like endless meetings to reconcile our many comments on the first draft, we released the document entitled, "Conserving Species at Risk and Vulnerable Ecosystems: Proposals for Legislation and Programs."



Illus.: Roelof Idema

We took a two-stream approach, identifying vulnerable ecosystems as well as listing species at risk. The concept of a vulnerable ecosystem answered the group's wishes to move towards a risk prevention strategy. Ideally, protection of species at risk in Canada would take place early in the endangerment phase through the protection of ecosystems; protection implying the inclusion of habitat management and conservation by users of the area. However, as species are the biological unit most easily identified with respect to level of endangerment, a species by species recovery must also be undertaken.

Not only has the document received support from various sectors and organizations, SARWG's initiative has helped shift the tone of the debate. The effort succeeded in building bridges among diverse, formerly polarized sectors. However, though comments and constructive criticism were sought from a variety of sources, the consultation process was by no means comprehensive. Additions may be required through the use of addenda, and at this point we are seeking letters of support.

Canada's biodiversity is eroding at an unprecedented rate. Declining species at the current rate are a symptom of biological systems out of balance. They are a warning signal, and it is crucial that everyone pay attention and act. A good first step is to enact effective endangered species legislation. Canada must adopt an approach that reflects its originality, its cultures, and its ways of working through dialogue, consensus and partnerships. The result must engage and be practical for people from all walks of life.

In a letter to Ministers, the following points highlight the key elements of SARWG's recommendations:

- We propose a "made in Canada" approach to include prevention as well as reach and cure measures. Our two-stream strategy for conservation of vulnerable ecosystems and species at risk provides these dual tools.
- Legislation and related programs must encourage, not discourage, all Canadians in cooperative partnerships to protect species and their habitats.
- The cost of preventing species extinction must be shared as per the principles of the UN Convention on Biological Diversity and not be borne solely by land-owners, resource users, workers and communities. The rights of these groups must be recognized in the legislation.
- The "listing" decision must be made by an independent, scientific body. Science is paramount in making good decisions. Our staged approach allows for scientific research to be furthered while ensuring the survival of individuals through interim protection in buffer zones.
- Legislation must ensure that no species become extinct in Canada due to a lack of legal protection. There can be no gaps in the federal/provincial/territorial safety net...
- Habitat conservation is crucial for the protection of species at risk and is to be addressed fully by all stakeholders in recovery plans.
- No "blanket" exemptions for activities that would violate species at risk legislation, but exemptions can be made on a case-by-case basis in public.
- Accountability will be ensured through strong, mandatory language in all legislation and an administrative appeal process.
- Adequate funding is essential for sound scientific research to ensure governments have the capacity to: implement and oversee the protection of species at risk, support recovery efforts, ensure adequate enforcement and, where appropriate, provide compensation.
- Changes to the tax system are essential to set the right fiscal framework for protection and to provide incentives for activities aimed at protecting and recovering species at risk and their habitats.

Announcing the Plant Names Project

by Eimear Nic Lughadha, Senior Scientific Officer, Herbarium, Royal Botanic Gardens, Kew; Peter Stevens, Professor of Biology, University of Missouri at St Louis and Curator, Missouri Botanical Garden; and Judy West, Director, Centre for Plant Biodiversity Research, Canberra

Bloodroot
Sanguinaria canadensis
Illus.: Roelof Idema

The Plant Names Project (PNP) is a collaborative venture by the Royal Botanic Gardens, Kew and the Harvard University Herbaria which have joined forces with the Australian National Herbarium's Centre for Plant Biodiversity Research. The PNP will create and maintain a comprehensive index of the names of all seed plants and make it freely available on the Internet as the International Plant Names Index (IPNI).

The partner institutions are committed to merging and standardizing the data held in their respective nomenclatural indices (Index Kewensis, the Gray Card Index and the Australian Plant Names Index). They will also develop the infrastructure to manage and edit the resulting dataset and make it available in a continuously updated form to as wide an audience as possible through the World Wide Web.

Development of the technology for this ambitious project is already well advanced with the pilot phase, part-funded by the U.S. National Science Foundation, now complete. This grant led to a proof-of-concept information system, using data on the authors of plant names. We now have a network of three database servers (at Kew, Harvard and Canberra) that functions collectively as an authoritative resource for users to find and retrieve basic data on authors of interest to them and also to contribute additions and corrections to the data held there.

The system design is technically exciting and innovative. The use of Java script (a versatile computer language not limited to any platform) will allow all potential users to benefit, regardless of their computer's operating system. Through our use of distributed object technology, the data and applications are made to appear local to the user, although they actually exist remotely on a network. This network will be decentralized, with the full data set replicated at a number of centres so as to avoid having a single point where a failure would disrupt all the users. Although there are currently just three nodes in the network, the system has been designed to be scaleable, that is, to include eventually many more contributors and editors at other institutions

Work on the most challenging aspects of the project—merging and standardizing the three plant names datasets—is now well underway. We plan to demonstrate IPNI at the International Botanical Congress in St. Louis, Missouri in mid-1999. This rapid progress has been made possible by a generous grant

WHAT IS A NOMENCLATURAL INDEX?

As a minimum, a nomenclatural index is a list of plant names with the names of their authors and a bibliographic reference to the work in which they were first published. Other data (e.g., the original material or name on which the new name is based or the reported geographical distribution of the plant named) may also be included.

A nomenclatural index is not a list of accepted names, nor does it offer taxonomic opinions on the names indexed—thus the IPNI complements rather than duplicates the objectives of initiatives such as the World Flora Checklist of the International Organization for Plant Information.

THE EXISTING INDICES

With worldwide coverage and over one million entries the Index Kewensis is probably the best known of the nomenclators which will be incorporated in the IPNI. It was Charles Darwin who suggested and in a bequest financed the compilation of the original volumes of the Index Kewensis, which aimed to list the names of phanerogams published from the time of Linnaeus to 1885. Since 1885 the Royal Botanic Gardens, Kew has compiled lists of all newly published plant names and supplements to the Index Kewensis are published at five-yearly intervals. Although quite comprehensive, the entries are not consistently edited and some early entries are incomplete.

The Gray Card Index covers vascular plant names for the entire New World from 1886 to the present. Originally published in the form of index cards the Gray Card Index now numbers over 350,000 names and has been accessible via the Internet since 1992. While there is considerable duplication with the Index Kewensis, in other ways the indices are complementary. For example, the Gray Card Index includes many infraspecific names and much information on types not covered by the Index Kewensis, and its entries have been edited but not checked.

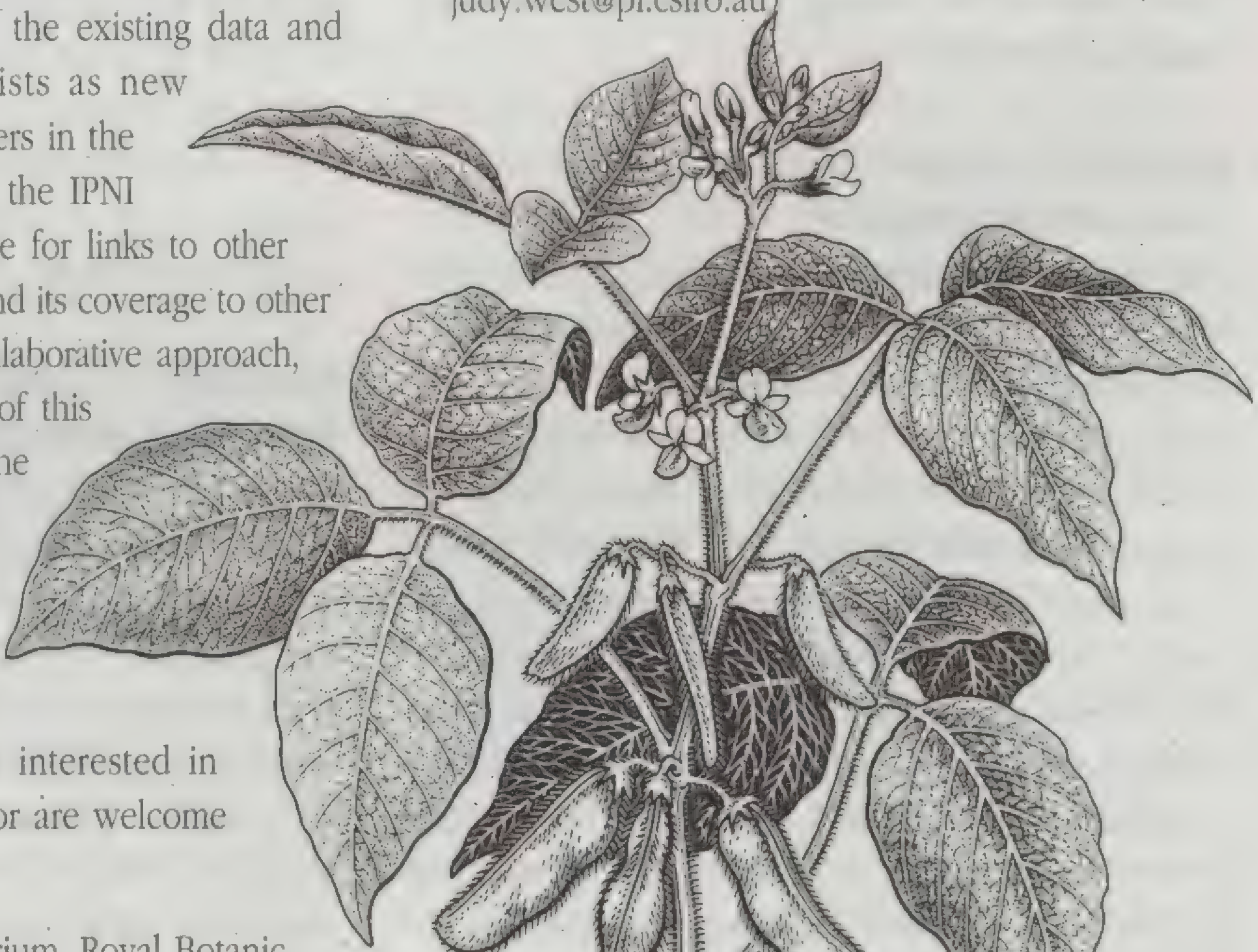
The Australian Plant Names Index (APNI) lists all scientific names used in the literature for Australian vascular plants. Begun in 1973, it now contains more than 62,000 names and most of these have been both edited and checked against their original place of publication.

from the U.S. National Science Foundation and the U.S. Geological Survey, together with ongoing financial support of the three partner institutions.

The IPNI will be the most comprehensive listing of the scientific names of plants. Although it will be neither complete nor error-free, it will facilitate the contribution of additions and corrections by users—those most likely to detect errors and omissions in the data. As well as correcting errors in the existing data and continuously updating the lists as new names are published, the partners in the Plant Names Project will make the IPNI available as a point of reference for links to other systematic data and seek to extend its coverage to other groups of plants. Through a collaborative approach, we hope to maximize the use of this invaluable reference source for the documentation and study of plant life.

More information is available on our web site at: http://pnp.huh.harvard.edu. Those interested in becoming a contributor or editor are welcome to contact:

- Eimear Nic Lughadha, Herbarium, Royal Botanic Gardens, Kew, TW9 3AE, U.K. (E-mail: e.lughadha @rbgkew.org.uk)
- Peter Stevens, Herbarium, PO Box 299, St Louis, MO, U.S.A. 63166-0299 (E-mail: pstevens@rschctr.mobot.org)
- Judy West, Australian National Herbarium, Centre for Plant Biodiversity Research, CSIRO, GPO Box 1600, Canberra, ACT 2601, Australia (E-mail: judy.west@pi.csiro.au)



Soybean
(Glycine max L.)
Illus.: Roelof Idema

CYBERDIVERSITY

U.S. WILDLIFE AGENTS CITE INTERNAL OBSTRUCTION

Special agents within the U.S. Fish and Wildlife Service (USFWS) report there is widespread obstruction of criminal investigations by USFWS managers. They further claim that agency decision-making is politically dominated, and that as a result, the USFWS enforcement program is doing a poor job protecting wildlife and is getting weaker. USFWS special agents are charged with enforcing the Endangered Species Act, Migratory Bird Treaty Act and all other U.S. federal laws governing hunting and interstate transport of wildlife. The report is the outcome of a new survey conducted by Public Employees for Environmental Responsibility (PEER). According to PEER, more than 60% of the roughly 200 special agents nationwide responded to a comprehensive survey and described a host of problems. Contact: Rob Perks, PEER, at: (e-mail) <rperks@peer.org> / (tel.) 202-265-7337 / (web) <http://www.peer.org>. [Condensed from *Great Lakes Habitat Watch* #134]

SWITCHING TO GREEN TAXES CUTS OVERALL TAX LOAD, SAYS WORLDWATCH

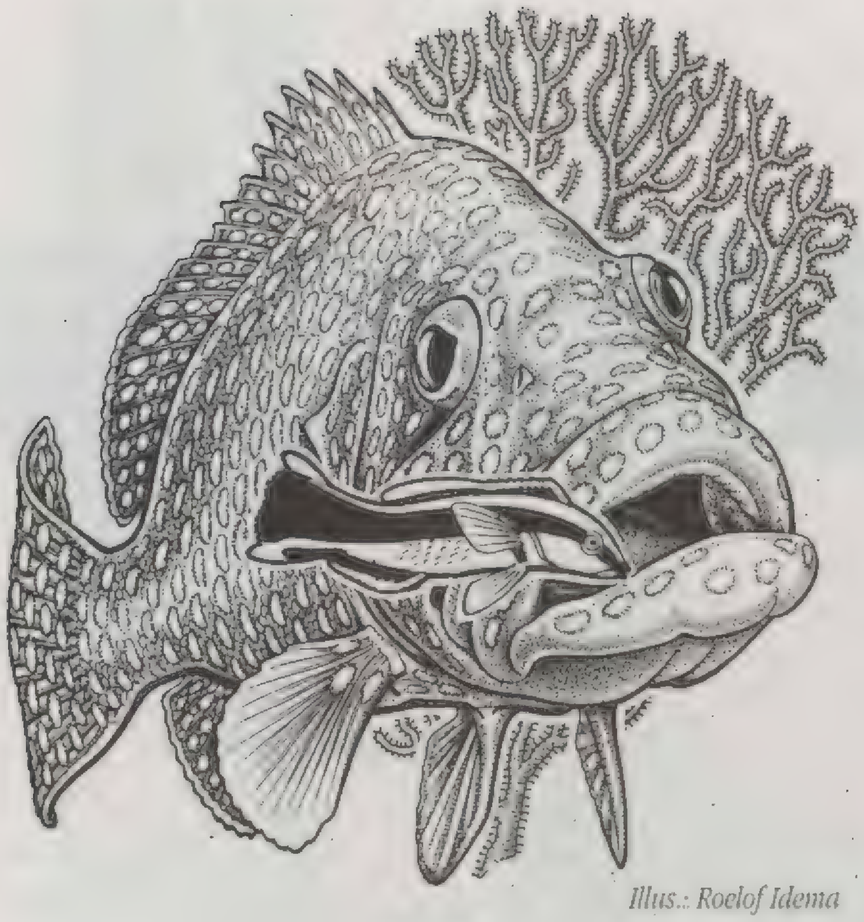
A green tax approach will solve many resource management problems, clean up the environment and help economies achieve sustainability, according to a study released this fall by the New York-based Worldwatch Institute. Entitled "The Natural Wealth of Nations: Harnessing the Market for Environment," the report says that ending unnecessary subsidies to the energy, forestry and fisheries industries would save $650 billion (U.S.) in taxes. Setting a modest levy for pollutant releases and resource depletion, the report continues, would add $1.5 trillion (U.S.) to the tax income. As a result, a U.S. family of four would see tax cuts of $2,000 per year. The report notes that in the 1990s, China cut subsidies for fossil fuel consumption from $26 billion to $11 billion a year; and the U.K. cut subsidies for coal production by 91% in the first half of the 1990s. As examples of using green taxes effectively, Worldwatch states that Germany used taxes to cut the production of toxic wastes by 15% in three years; and Australia, Denmark and the U.S. used taxes on CFCs to help phase out the chemicals. Contact: (e-mail) <mcaron@worldwatch.org> / (web) <http://www.worldwatch.org>.

INCINERATOR ASH DISPOSAL HARMING JAPAN FISHERIES

Municipal and hazardous waste is being dumped on a deserted island in the Seto Inland Sea, near Hiroshima, Japan. The run-off is killing the shellfish and having adverse effects on the area's commercial fisheries. Approximately one-third of Kamiguro Island has been used as a landfill for industrial waste since 1989. A Tokyo-based waste disposal company dumps incinerator ash and industrial sludge there, amounting to 62,000 tons in 1997 alone. Ninety-seven percent of this general waste comes from outside Hiroshima Prefecture. Contact: Japan Environment Monitor, (e-mail) <BYG05310@niftyserve.or.jp> / (web) <http://www.yin.or.jp/user/rdavis>. [Condensed from *The Gallon Environment Letter* 2(26)]

BIODIVERSITY CLEARING-HOUSE ON SCIENTIFIC AND TECHNICAL COOPERATION

The Convention on Biological Diversity Secretariat invites your contribution to the further development of the content of their (Meta-) Database on Internet-based Biodiversity Resources. All entries relate to biodiversity information management or scientific and technical cooperation in biodiversity. New entries will be publicly accessible after validation by the Secretariat. Other biodiversity Internet resources that contribute to the implementation of the Biodiversity Convention are also invited. Search the database at: <http://www.biodiv.org:8080/relinks/search.htm>. Enter data at: <http://www.biodiv.org:8080/relinks/



Illus.: Roelof Idema

add.htm>. Contact: Marc Auer, Programme Officer, Clearing-House Mechanism, Convention on Biological Diversity Secretariat, (tel.) 514-287-7024 / (e-mail) <marc.auer@biodiv.org> / (web) <http://www.biodiv.org>.

CLIMATE CHANGE IMPACTS CANADIAN COMPETITIVENESS

A study report entitled "Impacts on Canadian Competitiveness of International Climate Change Mitigation: Phase II" is now available on the Internet. Completed in November 1997, the study had been commissioned by the Canadian government from Standard and Poor's DRI business unit, but the results were not immediately released to the public. To view the report, go to: <http://www.dri.mcgrawhill.com/canada/ec2/index.htm>. The authors of the study, Christopher Holling and Robin Somerville, also published an article under the same title in the journal *Conservation Ecology*. To view the article, go to: <http://www.consecol.org/Journal/vol2/iss1/art3>. [Condensed from *The Gallon Environment Letter*, 2(22)]

PROTECTING THE GREAT LAKES BASIN

The U.S. Environmental Protection Agency (EPA) and Environment Canada (EC) reviewed their joint work at the 1998 State of the Lakes Ecosystem Conference (SOLEC) in Buffalo in October. The on-going SOLEC program identifies highly productive habitats in the Great Lakes Basin. A recent aspect of the binational initiative is to identify especially diverse and productive habitats in the basin—biodiversity investment areas (BIAs)—that warrant exceptional consideration and protection because of their current ecological value. The EPA and EC intend BIAs to be a strong compliment to the binational Areas of Concern—sites where environmental restoration is a priority due to past degradation. As well, the agencies have tried to clarify that BIAs should not be interpreted as the only places that need to be protected. They are the most productive or unique on a basin-wide scale, but productivity at every watershed scale is crucial for the health of the entire system. To view the Aquatic Biodiversity Investment Areas (ABIA) project, go to: <http://129.22.156. 152/ABIA/>. For information on other BIAs, go to: <http://www.epa.gov/glnpo/solec>. [Condensed from *Great Lakes Habitat Watch* #134]

IISD OFFERS ON-LINE REPORTS ON COP-4 AND CHEMICAL SAFETY MEETINGS

The International Institute for Sustainable Development (IISD) has published a final summary of the Fourth Conference of the Parties (COP-4) to the Framework Convention on Climate Change in both English and French in HTML and PDF formats. They recommend viewers go to the IISD analysis of the meeting, entitled "Something for Everyone in Buenos Aires", at <http://www.iisd.ca/vol12/enb1297e.html#analysis>. As well, IISD's Sustainable Developments (SD) reporting service was asked by the World Health Organization to cover the Third Meeting of the Intersessional Group of the Intergovernmental Forum on Chemical Safety, held in Yokohama in December. The SD's summary report will be posted to the ISSD Linkages site at: <http://www.iisd.ca/linkages/sd/isg3.html>. [Condensed from Linkages WWW, located at <http://www.iisd.ca/ linkages/>]

KID'S SITE ON TROPICAL FORESTS

The CIDA Forestry Advisers Network (CFAN) has launched a new website called Kid's Corner, geared to students wanting to learn about tropical forests. Viewers will find information on why these forests are important, what can be done to help save them, and what actions the Canadian International Development Agency (CIDA) is taking to secure them. Go to: <http://www.rcfa-cfan.org>.

BIODIVERSITY MEETINGS

Illus.: Roelof Idema

MARCH 20, 1999

4th Annual International Wildlife Law Conference

American University's School of Law, Washington, DC

Contact: Wil Burns, Managing Editor, *Journal of International Wildlife Law & Policy*, 1563 Solano Ave., Suite 193, Berkeley, CA, USA 94707 / Tel.: (510) 540-0980 / E-mail: <JIWLP@earthling.net>

APRIL 1999

Eighth Session of the FAO Commission on Genetic Resources for Food and Agriculture

Location TBA

Contact: FAO, Viale delle Terme di Caracalla, Rome, Italy, 00100 / Tel: 39-6-52251 / Website: <http://web. icppgr.fao.org>

MAY 3-7, 1999

The Application of Scientific Knowledge to Decisionmaking in Managing Forest Ecosystems

Asheville, North Carolina, USA

Contact: Dr. H. Michael Rauscher, USDA Forest Service, 1577 Brevard Rd., Asheville, NC 28806. USA / Tel: (828) 667-5261 / Fax: (828) 667-9097 / E-mail:<mrauscher/srs_bentcreek@fs.fed.us>

MAY 7-9, 1999

Global Biodiversity Forum (GBF)

San Jose, Costa Rica

Contact: Ramsar Convention Bureau, rue Mauverney 28, CH-1196 Gland, Switzerland / Tel.: 41-22-99-0170 / Fax: 41-22-999-0169 / E-mail: <ramsar@hq.iucn.org>

MAY 16-28, 1999

First Annual MacMillan Coastal Biodiversity Workshop

Bamfield Marine Station, Vancouver Island, British Columbia

A 13-day, non-credit workshop program open to senior undergraduate students, graduate students, junior faculty, as well as government employees interested in a unique, hands-on experience in coastal biodiversity research and surveys. All fees include tuition, full room and board for 13 days: under-graduate and graduate students $400; post doc fellows and faculty members $600; other public and private sector employees $800. Applications must include: statement of interest; university transcripts (undergraduate or graduate students only); short CV (no more than four pages). For deadlines or more information, contact: MacMillan Biodiversity Workshop, Bamfield Marine Station, Bamfield, B.C. V0R 1B0, Canada / Tel.: (250) 728-3301 / Fax: (250) 728-3452 / E-mail: <info@bms.bc.ca>

JULY 18-20, 1999

Workshop on Market-Based Instruments for Environmental Protection

Harvard University, Cambridge, Massachusetts

Contact: Professor Robert N. Stavins, John F. Kennedy School of Government, Harvard University, 79 John F. Kennedy Street, Cambridge, Massachusetts, USA 02138 / Tel.: (617) 495-1820 / Fax: (617) 496-3783 / E-mail: <robert_stavins@harvard.edu> / Website: <http://www.ecu.edu/econ/aere>

AUGUST 1-7, 1999

World Indigenous Peoples' Conference on Education

Hilo, Hawaii, USA

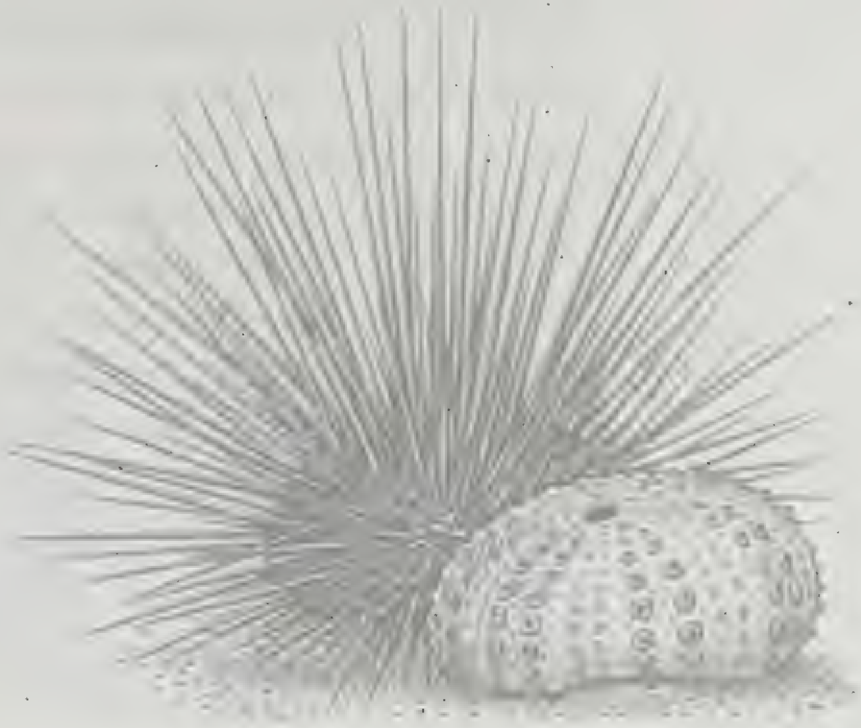
Contact: World Indigenous Peoples' Conference on Education, PO Box 6159, Hilo, Hawaii 96720-8923, USA / Tel.: 808-934-7722 / Fax: 808-969-7932 / E-mail: <wipc@hawaii.edu>

AUGUST 6-12, 2000

Quebec 2000: A Global Celebration of Wetlands

Quebec City, Quebec.

Contact: Quebec 2000, 2875 blvd. Laurier, bureau 620, St-Foy, QC G1V 2M2 Canada / Tel: (418) 657-3853 / E-mail: <cqvb@cqvb.qc.ca> / Web site: <http://www.cqvb.qc.ca/wetland2000/>



BOOK REVIEWS

Invertebrate Surveys for Conservation

New, T.R. 1998. Oxford University Press, Oxford, New York, Tokyo. ISBN 0-19-850011-4. 240 pages. Paper. (US) $35.

Most animals are invertebrates. But because most conservationists know little about them or how to survey them adequately, they are undervalued both for direct conservation and as tools for ecological assessment. *Invertebrate Surveys for Conservation* aims to provide practical guidance for invertebrate surveys, without overwhelming detail, and to introduce the rationale and needs for conservation-related studies of invertebrates. It opens with a chapter on the value and problems of studying invertebrates in conservation. Subsequent chapters treat approaches to surveys, terrestrial and aquatic sampling methods and their assessment, processing and interpreting samples, target groups, monitoring and evaluating conservation status, and alternative approaches not focusing on individual species. A final chapter highlights the need to educate and involve people in invertebrate conservation issues.

The book succeeds on a number of levels. The basic methods and components for these studies are clearly explained, and simple but very useful figures and tables provide helpful summaries of key information. The cited references are fully up to date, and each chapter has a few well selected titles for further reading. Wider issues are soundly developed, such as alternative approaches to the work, and the feasibility or problems of rapid assessments. The peculiarities and limitations, but also the great diversity and value of invertebrates, are demonstrated. Several important themes, often overlooked, are reinforced: to plan and conduct work with clear objectives in relation to conservation issues, and the need for taxonomic expertise and supporting infrastructures such as collections. The book calls for specific expertise and particular care and attention as there are so many taxa and so many methods and variations.

This book, covering such a wide area, has some imprecisions. For example: ethylene glycol is recommended for use in pitfall traps, but should not be in general use because it is both attractive and toxic to vertebrates (propylene glycol is preferred). Mortality and recruitment (other than dispersal) are not mentioned in interpreting mark-recapture methods despite their considerable influence on population estimates. The short index is somewhat limited and uneven, although the table of contents is relatively detailed.

In summary, *Invertebrate Surveys for Conservation* will be of great value to the conservation managers and practitioners to whom it is primarily addressed. Its sensible advice on how to develop, quantify, assess and use information about invertebrates, and its up-to-date background and discussion recommend it as well to a range of other readers including students.

H.V. Danks, Biological Survey of Canada, Canadian Museum of Nature, Ottawa

Marine Biodiversity: Patterns and Processes

Ormond, R.F.G., J.D. Gage and M.V. Angel (eds). 1997. Cambridge University Press, New York. ISBN 0-521-55222-2. Cloth. 472 pages. (US) $75

The largest ecosystem on this planet—the marine world—is one that our species cannot fully enter to experience its abundance, nor can we appreciate the full extent of our impact on it. Therefore, it is time for a concerted voice to raise public awareness of marine issues along with terrestrial concerns. Congratulations to Cambridge University Press for providing a broad volume of timely papers in *Marine Biodiversity: Patterns and Processes.* While the book does not profess to address the effects of ecosystem degradation, it does get at the fundamental controls on species abundances. And as we know, changes in diversity and distribution are primary responses to environmental change.

The editors of the volume are major figures in marine studies and thereby imbue the work with their insight and authority. Their British bias, however, is strongly evident: contributions by Russian, German, French or Mediterranean scientists are lacking. The result is a certain uniformity of expression in several papers with U.K. and U.S.A. sources.

The 18 papers touch many subjects around diversity: gradients and patterns, specific environmental responses, genetic approaches and biodiversity conservation. Many site-specific studies already exist in the literature, so it was refreshing to see a review approach taken that leaves the reader with a global view and generalized concepts. There are many good starting points for research papers in this volume, but each author approaches diversity differently, leading to unequal treatment of the ocean habitats. Weak coordination among chapters means the same material surfaces in several places, though it is educational to see alternative or conflicting interpretations of the same data. Such is the way of ecologists.

Highlights of the book include the call to re-examine the view of deep-sea diversity that appears in many of our textbooks. It has been 30 years since Howard Sanders published the depth gradient of diversity that was pivotal in moving marine ecology forward. We owe it to both this remarkable man and to our students to push this work forward. Another highlight is an approach in several papers that emphasizes the historical and geological controls on diversity; the alpha-diversity approach needs this breadth. Finally, I was intrigued by the final chapters addressing protection and management: while sobering, they give hope that methods for making decisions can balance our multiple dependencies on the ocean with those of marine inhabitants.

Verena Tunnicliffe, Professor, School of Earth & Ocean Sciences and Dept. of Biology, University of Victoria, British Columbia

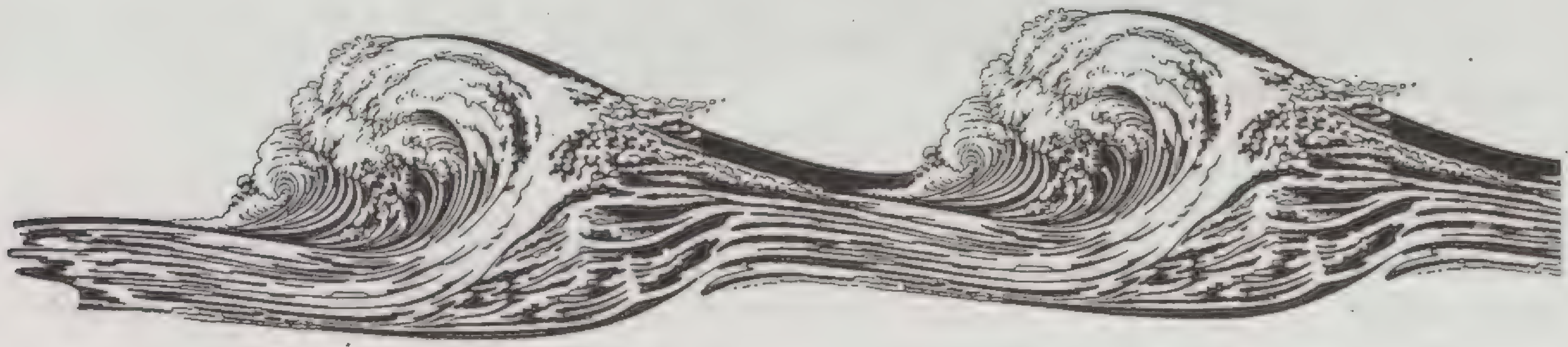
NEW TITLES OF INTEREST...

The Firefly Nature Encyclopedia
1998. Firefly Books Ltd. 304 pages/2,000 colour illustrations. ISBN -155209-268-2. Cloth. (CDN) $49.95.

Fundamentals of Biogeography
Huggett, Richard John. 1998. Routledge. 261 pages. ISBN 0-415-15498-7. Cloth (US)$75. [CDN $105.]. ISBN 0-415-15499-8. Paper. (US)$24.99 [CDN$34.99].

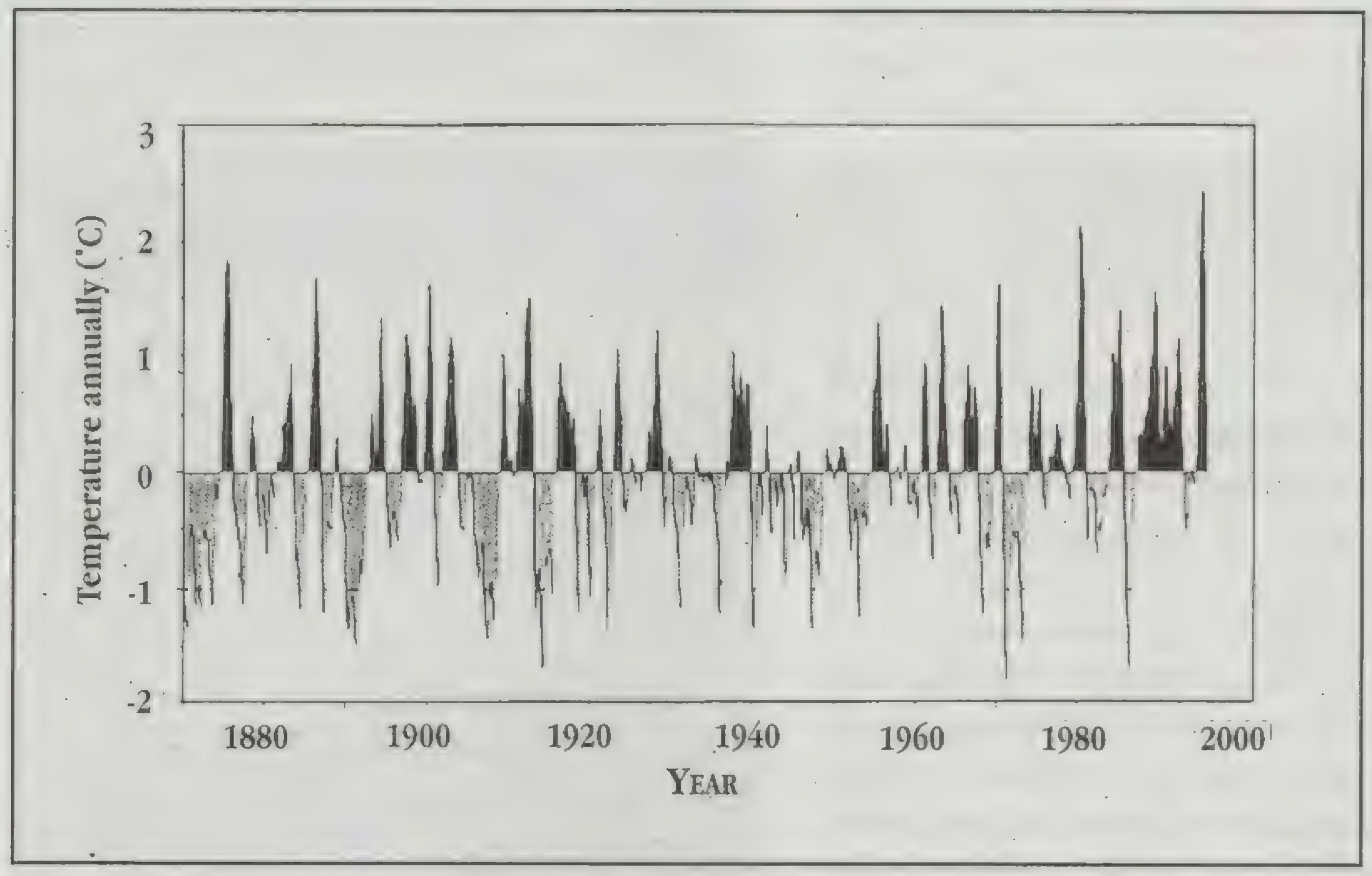
Learning About Biodiversity: A First Look at the Theory and Practice of Biodiversity Education, Awareness and Training in Canada / L'apprentissage de la biodiversité : coup d'œil sur la théorie et la pratique dans l'éducation, la sensibilisation et la formation en matière de biodiversité au Canada
Biodiversity Convention Office, Environment Canada (e-mail: <bco@ec.gc.ca>). 1998. 52 pages. ISBN 0-662-63671-6.

Measures of Success: Designing, Managing, and Monitoring Conservation and Development Projects
Margoluis, Richard and Nick Salafsky. Biodiversity Support Program. 1998. Island Press. 363 pages. ISBN 1-55963-612-2. Paper. (US)$35.

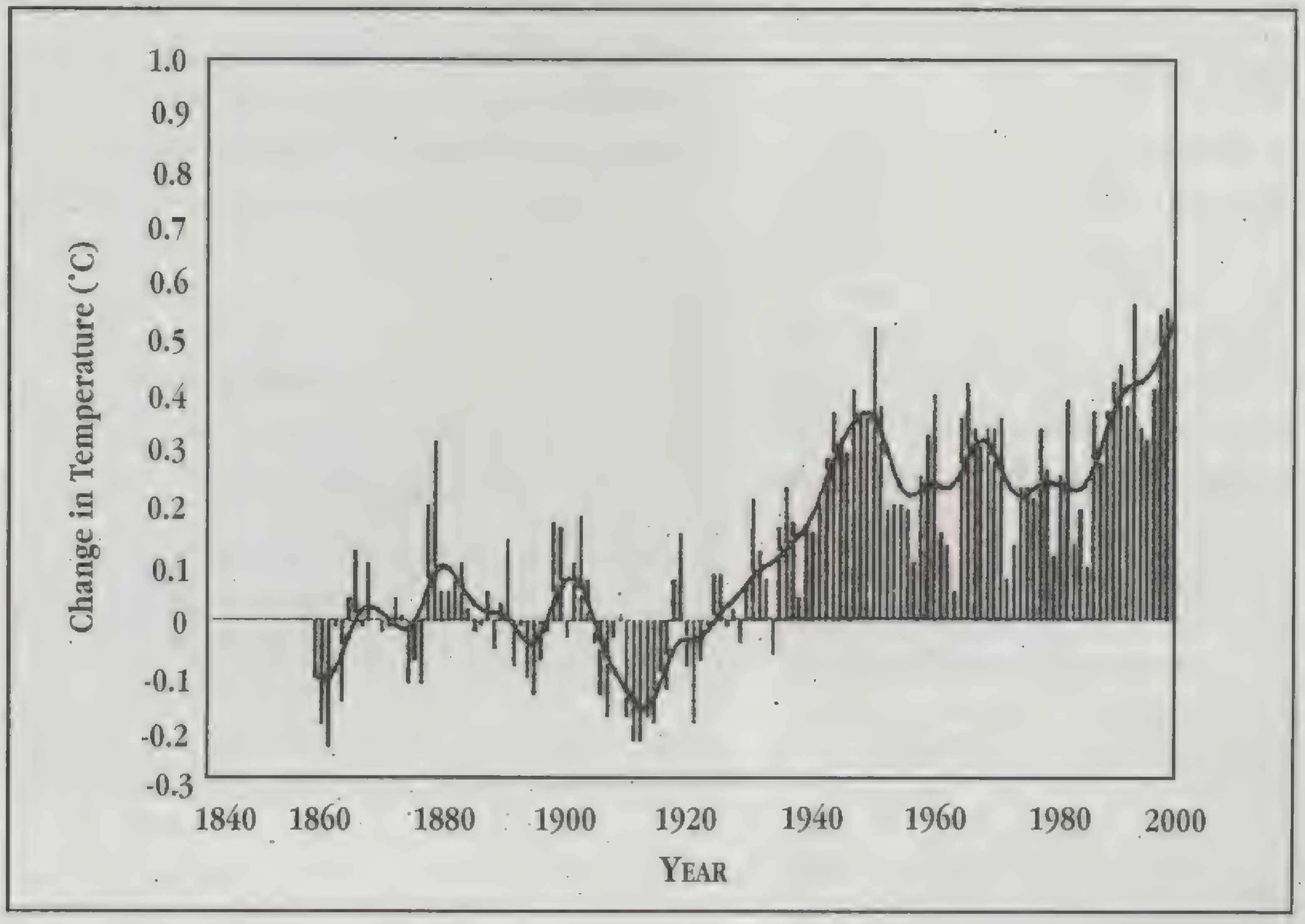


Editor's Notebook, continued from inside cover

El Niño effect: Changes in sea-surface temperature 1871-1998, relative to the 1961-90 average, for the eastern tropical Pacific off Peru.



Climate warming effects: Changes in the global annual mean planetary surface temperature, relative to that at the end of the last century. The value for 1998 includes observations up to the end of September.



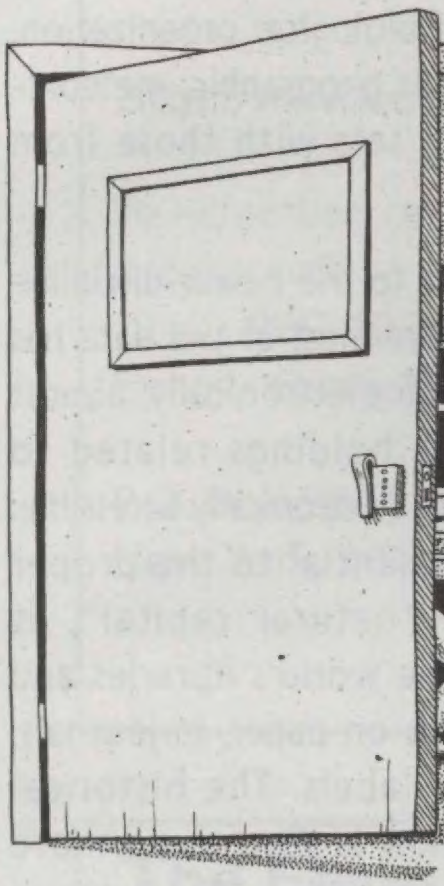
Two large marine ecosystems are suffering widespread serious effects right now. It is time for governments to act. It is time for global organizations like the WTO and the IMF to require real—not decorative or voluntary—adherence to environmental standards and to revamp their accounting systems to include environmental capital. Otherwise, the environmental, social and economic debts incurred will be substantial.

Don E. McAllister
Editor-in-Chief

THE LAST WORD

Keeping up to date with nature

Biological informatics promises tools to integrate life sciences information



Environmental policy makers around the world are beginning to accept that there are essential links between a healthy economy and a healthy environment. They acknowledge that "environmental stewardship involves more than protecting nature for its own sake"[1]. They increasingly recognize that nature's contributions to our economy include not only direct services such as food production, raw materials and genetic resources, but also indirect "ecosystem services" such as nutrient cycling, waste treatment, pollination, biological control and climate regulation. The biological diversity that supports these **"nature's services"** is now being characterized as our **"natural capital"**[2]

As our understanding of economic and environmental interdependence increases, policy makers are forced to recognize that economic approaches designed to protect natural capital and its associated ecosystem services are far more cost effective than approaches that attempt to recreate these services after they've been damaged.[3] Policy makers, forced to decide between often conflicting approaches to managing our "natural capital", are in urgent need of accessible, interpretable and comprehensive "environmental knowledge bases". These knowledge bases must include:

- catalogue of species;
- information on each species' status, genetic variability, distribution and function;
- information on potential threats;
- estimates of each species' economic contribution;
- hierarchical, spatially-explicit eco-zone, eco-region and eco-district descriptions and assessments;
- integration with land cover and land utilization mappings.

Although some of this information is now available, it is not easily accessed in an interpretable format. It is scattered through the files and holdings of various libraries, museums, federal and provincial agencies, NGOs, industry and academia.

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[1] (The Liberal Plan - 1997. "Securing Our Future Together" http://politicscanada.com/platforms/liberal/)

[2] (Teaming with Life: Investing in Science to Understand and Use America's Living Capital, Office of Science and Technology Policy Washington, DC)

[3] (Costanza et al. 1997. The value of the world's ecosystem services and natural capital. *Nature*, 387, 253-260)

A FEW WORDS ABOUT THE CANADIAN MUSEUM OF NATURE

The origins of the Canadian Museum of Nature (CMN) were formed within the Geological Survey of Canada in 1842. Over 150 years later, the CMN has some 10 million specimens in its collection—which still represents only half the known species in this country—and an active team of scientists, collection managers, education specialists, and business experts.

The CMN's mandate is to increase knowledge and understanding of, appreciation and respect for, and interest in the natural world. This role has never been more crucial, as the demand for environmental harmony between the world's burgeoning human population and nature reaches a critical point. For more information about the Museum's activities, please contact Joanne Charette, Corporate Communications at (613) 566-4249.

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Filling in the gaps and integrating the data into a useable environmental knowledge base is obviously a long-term project. Fortunately, advances in information management theory, communications technology and computer systems already provide the tools to quickly initiate this development. For instance, networked computers in the workplace provide the hardware infrastructure and computational power necessary to make use of, and add to, this knowledge base. Access to technology is no longer a major barrier.

The real barrier to this development appears to be more cultural than technological. Traditional attitudes of individuals and organizations towards data ownership and data sharing make it difficult to develop the partnerships necessary to access, integrate and analyze information about our "natural capital". The urgent need for current and historical biodiversity information requires a new way of doing business.

The emerging discipline of "biodiversity informatics" promises the tools and approaches to integrate information across the life sciences disciplines. By applying the new information technologies to these disciplines, this branch of biological informatics will dramatically alter not only how we analyze and store information about biological systems but also how industries based on the life sciences are able to utilize this information. The kinds of impacts that information technology has already had in the transportation, banking and communication industries are about to be realized in the life sciences based industries, such as agriculture, fisheries, forestry and environmental management. Canada, with large investments in these economic sectors, will be at a real disadvantage if not prepared to manage and exploit the massive amount of new knowledge issuing from biological research. The development of strong, national, biodiversity informatics capacities is critical if we want to protect our environment while ensuring competitive and sustainable natural resource industries.

Until recently, most advances in biological informatics were geared towards handling molecular biology data. The ready use of this data in agriculture and medicine resulted in governments and industries making large investments in molecular technologies and related information management activities. Similar support is needed to make taxonomic and ecological data accessible and useable. With this transformation, we can expect to realize economic gains as significant as those demonstrated by the advances in molecular biology informatics. Additional benefits will come from the new conceptual links made by researchers as they pull together data across disciplines and across different levels of biological organization. They will integrate various geographic, meteorological, and other data sets with those from taxonomy and ecology.

Unfortunately, in contrast to the newer discipline of molecular biology where most of the data has been captured and stored electronically, almost none of our vast data holdings related to taxonomy and ecology are electronically accessible. This information, so essential to the proper management of our "natural capital", is "institutionalized" in the world's libraries and natural history collections on paper, in journals, books or on specimen labels. The historical biodiversity information is now even more important, for a variety of reasons. For instance, large-scale habitat changes have made much of the older information irreplaceable. Since the results of taxonomic and ecological research do not rapidly go out of date, we need significant investments to transfer much of this critical information to an electronic format.

To move quickly, as the needs of biodiversity appear to demand, the results of both present and past generations of biodiversity scientists must be made readily and comprehensively available to current researchers and decision makers. Holders of biodiversity information urgently need support to digitize this information, make it electronically accessible and to develop the tools to integrate this information into the environmental decision making process.

Larry Speers, Coordinator
CanBII - Canadian Biodiversity Information Initiative
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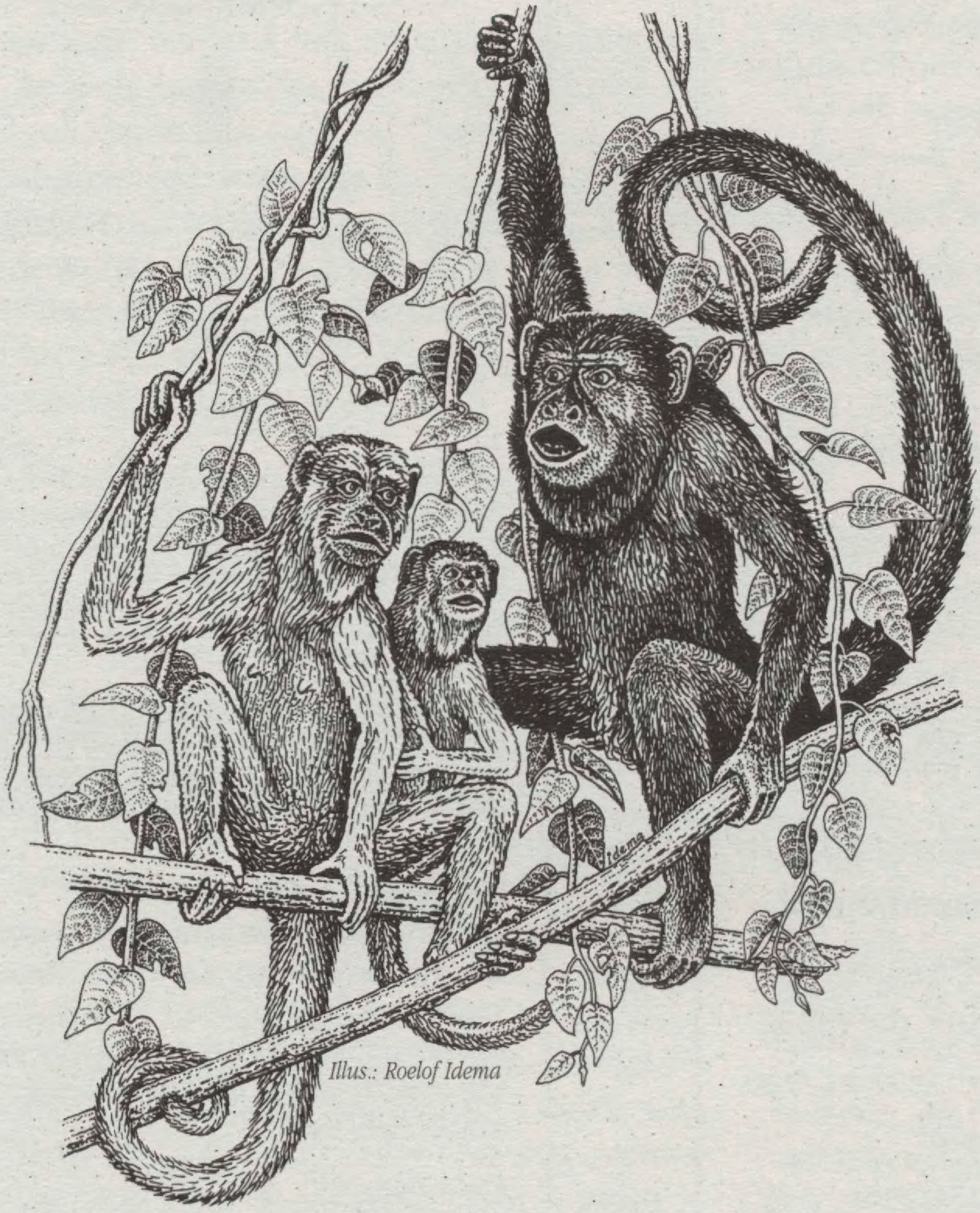

Illus.: Roelof Idema

The black howler monkey, *Alouatta pigra,* is a large primate found in Mexico, Guatemala, Belize and possibly, northern Honduras. As their name suggests, the black howler adult males make loud, sonorous howls that can be heard for more than two kilometres through the forest.

The goals of *Global biodiversity* are to:

▪ *Publish articles, views, and news on biodiversity* ▪ *Bridge the gaps between professional disciplines & the public* ▪ *Communicate vital information to help humankind make decisions on the fate of the Earth's life* ▪ *Express views on the needs & value of biodiversity research* ▪ *Provide an international forum for discussing issues on biodiversity* ▪ *Enhance awareness of the role of biosystematic research & museum collections to conservation & ecologically sustainable use of biodiversity* ▪ *Discuss methods and philosophy of biodiversity conservation* ▪ *Review books and periodicals on biodiversity*

Published by Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P 6P4, Canada.
ISSN 1195-3101 (English Edition) ISSN 1195-311X (édition française)

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